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(54) Automatic machine for filling and closing flasks or the like containers.

(57) All the carousels of the machine are provided with grippers for holding the flasks. A carousel with grippers (6) for holding the flask by the neck is followed by a carousel with grippers (7) for holding the flask by the body and so on. Between the jaws of each gripper there is provided in the middle region a vertical opposition element (35) fixed onto a horizontal slide (36) supported by the gripper body (33) and connected to means which modify the position of the said opposition element according to the diameter of the flasks. The opposition element is directed towards the flask with a concave-profile front face. The orbits (29, 30) along which the grippers of two consecutive carousels travel intersect each other in the zone where the flasks pass from one carousel to the other. In this zone the flask is immediately held between the opposition elements of the opposite grippers of the carousels, which open and close alternately. The opposition elements of one of the two consecutive carousels are spring-mounted. Preferably the opposition elements of the grippers of the operating carousels are immobile and the opposition elements of the grippers of the service carousels are spring-mounted. Special variable-profile cams control the transfer of the flasks between the carousels of the machine.

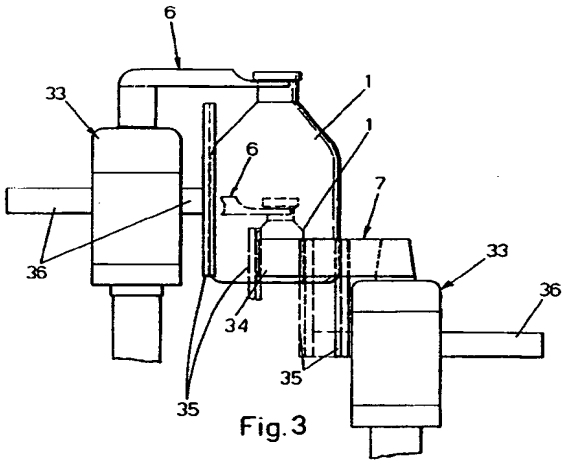

Fig.3

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The present invention relates to an automatic machine with a high production output and great degree of operational flexibility, used for filling and closing flasks or other containers.

Flask filling and sealing machines formed by a succession of carousels are known, some of these carousels being provided with grippers for holding the flasks, while others are of the so-called star-type with perimetral alcoves into which the flasks themselves fit snugly. In the case of star-type carousels, the star devices must be replaced when there is a variation in the size of the flasks, and the flasks themselves rub against fixed parts guiding and retaining the actual flasks inside the alcoves of the star devices.

The invention aims to overcome this first drawback with a machine formed by a succession of carousels, all provided with grippers which alternately grip the flasks by the neck and by the body, it being preferably envisaged that, in the main carousels where filling and sealing is performed, the flasks are gripped by the body so that their top part is completely free for the operating means and is in the best possible state for receiving any flow of gases which ensure hygienic or sterile conditions for packaging of the product inside the said flasks.

In machines of the known type, where cooperation between two carousels with grippers may be necessary, the grippers of a carousel are operated so as to be able to oscillate in advance or with a delay on an axis parallel to that of the carousel itself, so as to follow over a sufficiently long section the orbit on which the grippers of another carousel are moving and so as to have a sufficient amount of time for the opening and closing operations, even in the case of high peripheral speeds of the carousels. This solution involves constructional complications, in particular on account of the adjustments which are necessary when there is a variation in the size of the flasks.

According to the invention, this drawback is overcome in that the grippers are mounted on the carousels in a fixed radial arrangement and the orbits along which the grippers of consecutive carousels move intersect each other. Between the jaws of each gripper, in the middle position, there is provided a vertical opposition element which acts on the body of the flask and which is directed towards the latter with a concave self-centering profile. Moreover, the opposition elements of the grippers of a carousel, preferably the operating carousels, are immobile and the opposition elements of the grippers of the other carousels are mobile against the action of elastic means. During the transfer of a flask from one carousel to another, the flask itself is gripped, on opposite portions of its body, by the opposition elements of the grippers of the two carousels, such that the gripper themselves are able to alternate safely during opening and closing. With grippers thus designed, the flask remains permanently pressed, with its body, against the opposition element of the gripper which retains it by the neck or body, ensuring greater positional stability of the flask itself.

This solution is suitable for being able to handle a wide range of flask sizes, without having to effect major replacements of parts of the machine. Via the machine's control panel it is possible to perform automatic adjustment of the position of the opposition elements and the advance and delay in the opening sequence of the grippers and all those adjustments which are necessary when there is a variation in the size of the flasks being processed.

These and other features of the machine in question, and the advantages resulting therefrom, will emerge more clearly from the following description of a preferred embodiment of the said machine, illustrated purely by way of a non-limiting example in the figures of the sixteen enclosed drawings, in which:

- Fig. 1 is a schematic plan view, from above, of the machine version suitable for packaging flasks of cosmetic, pharmaceutical or medicinal products;
- Fig. 2 is a plan view, from above, of the operating sequence of the grippers of two consecutive carousels, during transfer of a flask from one carousel to another, in particular from a transfer carousel to an operating carousel;
- Fig. 3 is a side elevation view of a pair of grippers of two consecutive carousels during transfer of a flask from one gripper to the other;
- Fig. 4 is a plan view, from above, of the operating sequence of the grippers during transfer of one flask from an operating carousel to a transfer carousel;
- Fig. 5 is a front view, with parts sectioned, of a mechanism with gripper and opposition element of any one of the machine carousels;
- Figs. 6, 7, 8 and 9 illustrate the constructional details of the mechanism shown in Figure 5, sectioned along the lines VI-VI, VII-VII, VIII-VIII and IX-IX, respectively;
- Fig. 10 is a side view, with parts sectioned, of the flask filling carousel;
- Fig. 11 is a side view, on a larger scale and with parts sectioned, of the actuating system for opening and closing the grippers of the carousels;
- Fig. 12 is a plan view of the cam and driving elements for positioning of the opposition elements of the grippers, which varies according to the size of the flasks being processed;

- Fig. 13 is a plan view of the cam and driving elements for controlling opening and closing of the grippers of the flask filling carousel or sealing carousel;
- Fig. 14 is a side view, with parts sectioned, of the flask sealing carousel;
- Fig. 15 is a side view, with parts sectioned, of the details relating to the grippers and the opposition elements of the sealing carousel;
- Fig. 16 is a side view, with parts sectioned, of one of the carousels for transferring the flasks;
- Fig. 17 is a view, on a larger scale and with parts sectioned, of a detail relating to the double-acting cam which controls and, where necessary, modifies the heightwise position of the grippers of the various carousels forming the machine;
- Figs. 18 and 19 are respectively a perspective view, broken down into its main components, and a plan view from above of the variable-profile cam which controls opening and closing of the grippers of the first transfer carousel;
- Fig. 20 is a schematic view, extending in a planar direction, of the profile of the cam according to Figures 18 and 19;
- Fig. 21 is a plan view of the cam which controls opening and closing of the grippers in the second transfer carousel;
- Fig. 22 is a schematic view, extending in a planar direction, of the profile of the cam according to Figure 21.

From Figure 1 it can be seen that the empty flasks 1 are conveyed in single file by a conveyor 2 to a known twin-augur intercepting device 3 which with its helical screw engages with the line of moving flasks and separates and feeds them in a synchronised manner to a following vertical-axis carousel 4 which rotates in the direction of the arrow 5 and which is provided with equidistant grippers 6 arranged so as to grip the flasks by the neck. The augur intercepting device 3, the carousel 4 and all the other components of the machine which must operate in synchronization with each other are actuated by a single driving source. The empty flasks, which are transported by the grippers of the first transfer carousel 4, are transferred in a synchronised manner to the grippers 7 of a vertical-axis carousel 8 which rotates in the direction indicated by the arrow 9 and with which means for introducing into the flasks metered amounts of fluid products are associated. The grippers 7 grip the flasks by their body. The flasks filled with product by the filling carousel 8 are transferred from the latter to the neck-holding grippers 6 of a second vertical-axis transfer carousel 10, similar to the carousel 4, which rotates in the direction of the arrow 11 and which transfers said flasks to the body-holding grippers 7 of a following vertical-axis carousel which rotates in the direction of the arrow 13 and which seals the flasks with a stopper. 14 denotes the loader inside which the stoppers are stored loosely and which aligns the stoppers in single file along a line 15, in a predetermined direction, and which feeds them to a small vertical-axis transfer carousel 16 which rotates in the direction of the arrow 17 and which transfers the stoppers themselves in a synchronised manner to the stations of the sealing carousel 12. The full and sealed flasks are transferred from the sealing carousel 12 by means of a known type 18 also provided, for example, with a twin augur, as described in the separate patent application in the name of the Applicant, which sort the flasks themselves onto two conveyor lines 19 and 20, depending on whether or not the flasks themselves are correctly filled and/or correctly sealed.

The flasks transported by the first transfer carousel 4, using a statistical control method are periodically checked for their tare weight and the said flasks, during subsequent transportation by the second transfer carousel 10, are checked for their gross weight, so as to verify via special processing means whether or not the weight of the packaged product is within the permitted limits. As a result of this verification, it is possible to correct, if necessary, operation of the metering devices functioning within the filling carousel or to stop the machine in the case of serious discrepancies. The flasks whose tare weight must be statistically checked are removed from the first transfer carousel 4. The flask which must be weighed is not transferred to the filling carousel, but is retained by the gripper 6 of the carousel 4 and is rapidly taken hold of, in a synchronised manner, by the body-holding gripper 7 of an arm 21 which rotates on the vertical shaft 22, in the direction of the arrow 23 and which transfers the flask onto an electronic weighing unit 24. In a synchronised manner this flask is then reintroduced into the transfer carousel 4 and when the station of this carousel passes opposite feeder means 3, the latter will have left a space unfilled so that the said flask is able to continue towards the next filling carousel 8 on to which it will be transferred. For this purpose the feeder means 3 may be constructed in accordance with Patent Application No. B093A 000488 in the name of the same Applicant. The means 7, 21, 22, 23 will also be referred to below as the carousel of the first weighing unit. The flasks whose tare weight has been checked are subsequently removed, during transfer onto the second transfer carousel 10, by a body-holding gripper 7 associated with an arm 25 rotating on the vertical shaft 26, in the direction of the arrow 27, which transfers the flask itself to a sec-

ond weighing unit 28. The parts 7, 25, 26, 27 will also be referred to below as: the carousel of the second weighing unit. After the gross weight has been recorded, the flask is re-introduced into a gripper of the transfer carousel 10, which is empty as a result of a flask not being transferred from the first transfer carousel 4 to the filling carousel 8. The units 28 and 24 are connected to a processing unit which transmits the necessary information to the electronic microprocessor unit which controls operation of the machine via the aforementioned logic system.

During the entire working cycle, the flasks are retained by the grippers, as a result of which the following advantages may be obtained:

- the flasks do not rub against fixed parts, as occurs in the case of star-type transfer carousels, thus avoiding the formation of particles which could contaminate the packaged product inside the flasks;
- with the grippers it is possible to handle a range of flasks of widely varying dimensions, without having to perform manual replacement or adjustment operations, as explained in greater detail below;
- in the filling carousel and sealing carousel, the flasks are held by their body so that their top part is completely free and accessible for the means which are required to perform introduction of the product and subsequent sealing. The mouth of the flasks is moreover in the optimum condition for being enveloped by the flow of cleaning and/or sterilising gases which are circulated inside the chamber 116 which houses the various parts of the machine described with reference to Figure 1, in the case where the machine itself is intended for the packaging of medicinal, pharmaceutical or cosmetic products.

From Figure 2 it can be seen that the flasks carried by the grippers of a carousel, for example by the grippers 6 of the transfer carousel 4 (or 10) travel along an orbit 29 which intersects the orbit 30 travelled by the flasks of the following carousel, for example the filling carousel 8 (or the sealing carousel 12), at the points denoted by 31 and 32, corresponding to the ends of arcs of circles which are sufficiently long and in the middle region are situated at a distance from one another which is much smaller than that shown since the radius of the aforementioned orbits is in reality much greater than that shown in the drawings. The bodies 33 of the carousel grippers remain in a fixed radial direction with respect to the said carousels, namely the mid-plane with respect to which the jaws of the grippers perform symmetrical opening and closing movements remains fixed and is radially arranged with respect to each carousel. The grippers 7 for holding the flasks by their body (see also Fig. 3) are provided with jaws having a flat shape and a height such that they are able to embrace a sufficiently high section of the flasks themselves and terminate with sections 34 which are bent inwards and, where necessary, lined with shock-resistant material and which, during closing, push the flask so as to adhere to the concave face of a vertical opposition element 35 which has a V-shaped profile in plan view and is equidistant from the jaws of the gripper and fixed to the end of a horixontal slide 36 which passes through the middle part of the body 33 of the said grippers and which is radially arranged with respect to the carousel. It is not excluded that the active face of the opposition element 35 may also be advantageously lined with shock-resistant material. The flasks controlled by the filling carousel 8, the sealing carousel 12 and the two carousels of the weighing units 24, 28 are supported substantially in three zones of the same annular band, located at the vertices of a hypothetical equilateral or isosceles triangle.

The grippers 6 for holding the flask by the neck are provided with horizontal flat end parts having concave facing zones 37 on its inner sides. The grippers 6 are also provided with a vertical opposition element 35 which is similar to that of the grippers 7 described above and also cooperates with the flask body. From Figure 3 it can be seen that the opposition element 35 of the grippers 6 is such that, even during the handling of large-size flasks, the opposition elements 35 of the grippers 6 and 7 of two consecutive carousels have opposite portions which engage with the same annular band of the flask body.

Means, described below, are provided for modifying the distance of the opposition element 35 from the body 33 of the grippers when there is a variation in size of the flasks.

Means are also provided such that the position of the opposition elements 35 of the grippers 7, once established, remains fixed and such that the position of the opposition elements 35 of the grippers 6 may, on the other hand, be modified in the vicinity of the gripper body 33, against the action of an elastic means which tends to bring the opposition element itself back into the position which normally corresponds to the size of the flask being processed.

With reference to Figure 2 which, from left to right, shows the working sequence of the grippers when a flask passes from a transfer carousel 4 or 10 to the filling carousel 8 or to the sealing carousel 12 or to one of the two carousels of the two weighing units 24, 28 (Fig. 1), it can be seen that a gripper 6 meets up, closed around the flask 1, with a gripper 7 which, on the other hand, is open. At the point of intersection 31 of the orbits 29, 30, the

flask is still held by the gripper 6 and its body is in contact with the facing opposition elements 35 of the said gripper 6 and gripper 7. The gripper 7 is made to close and the gripper 6 to open and, during this phase, the grippers have all the necessary space available to reach the second intersection point 32 of the orbits 29, 30, during which the flask is firmly held by the opposition elements 35 and passes from the orbit 29 to the orbit 30, owing to the possibility of spring-loaded retraction of the opposition element 35 of the gripper 6. All of this clearly ensures safe operation, even in the case of a high peripheral speed of the carousels.

Figure 4 shows, from right to left, the sequence for the transfer of a flask from one carousel with grippers 7 and a fixed opposition element 35 to a carousel with grippers 6 and a spring-mounted opposition element 35. Following the direction of rotation of the two carousels, it can be seen that the flask held by a gripper 7 and travelling along the orbit 30 intersects, at 31, the orbit 29 of the grippers 6 and at this point cooperates with an open gripper 6, while the body of the flask cooperates with the opposition elements 35 of the two grippers. When passing from the entry intersection point 31 to the exit intersection point 32 of the orbits 30, 29, the flask remains along the orbit 30 owing to the elastic reaction of the opposition element 35 of the gripper 6 and, in a synchronised manner, the jaws of the gripper 7 open, while those of the gripper 6 close. The pressure which the opposition element 35 of the grippers 6 exerts on the body of the flask will obviously be such that it does not damage the said flask. Before leaving the point 32, after which the flask will have been definitively transferred into the orbit 29 of the carousel to which it is being transferred, the neck of the flask itself will cooperate with the concave zone 37 of the discontinuously shaped inner sides of the gripper 6 to which the flask itself will be firmly secured, also owing to the fact that the corresponding body rests against the opposition element 35 of this gripper, which, at the point 32, reaches the position where it is fully most extended from the corresponding gripper body 33.

With reference to Figures 5, 6 and 7, it can be seen that the body 33 of the grippers is formed by an intermediate part 38 closed at the top and the bottom by covers 39, 40 fixed with suitable ties. The part 38 supports rotatably, by means of pairs of bearings 41, 42, hollow and vertical spindles 43, 44 which project from the top cover 39 via openings lined with gaskets 45, 46, the upper end parts 47, 48 of the cavity of these spindles having a cross-section with one or more flat surfaces, as per the detail of Figure 9, into which there may be inserted and keyed the upper portions 49, 50, with a matching cross-section, of the shanks of the heads 51, 52 which carry the jaws of the grippers 6 or 7 described above. The shanks 53, 54 of the gripper-carrying heads have a round cross-section and fit precisely into the said hollow spindles 43, 44 where they are retained axially by the snap-engagement cooperation of their annular recesses 57, 58 with the spring-mounted spheres 55, 56 mounted on the said spindles. Inside the cover 39, the spindles 43, 44 have keyed to them, by means of cotters 59, 60, respective toothed segments 61, 62 which mesh with each other, as per the detail of Figure 6, so as to synchronise the opening and closing movement of the jaws of the grippers 6 or 7.

The bottom cover 40 of the body 33 of each gripper has fixed to it the top end of a pair of vertical tubes 63, 64 which are axially aligned with the spindles 43, 44 and which slide, axially guided, inside parts 65, 66 of the carousel body, described in more detail below, so as to allow, where necessary, the raising and lowering movements of the jaws (see below). Inside the tubes 63, 64, there are rotatably mounted, by means of end bearings 67, 68, shafts 69, 70 which with a section of larger diameter project at the bottom from the said tubes and are fixed at their bottom end, via bearings, to a carriage 71 which with its own pair of wheels 72 rests and slides on the opposite surfaces of an annular double-acting cam 73 coaxially arranged in the carousel and shown more clearly in the detail of Figure 17.

The shaft 69 enters into the body 33 of the gripper where it is fixed to a hub 74 which in turn is inserted and keyed by means of the cotter 75 inside the bottom end of the spindle 43. Suitable oscillation of the shaft 69 causes opening and closing of the jaws of the gripper 6 or 7 associated with the heads 51, 52. This oscillation is achieved by the cooperation, with a suitable cam coaxially arranged in the carousel and not visible in Figure 5, of the end rollers 76 of a lever 77, the hub of which is rotatably supported by a part 78 of the carousel body and has passing through it axially the shaft 69 which longitudinally has at least one groove 79 for keying to the corresponding cotter 80 of the said hub. It remains understood that keying between the hub of the lever 77 and the shaft 69 may be achieved in a different manner with a so-called splined-shaft coupling.

In the same way the shaft 70 derives an oscillating movement from a cam coaxially arranged in the carousel, not shown in Figure 5, with which the end rollers 81 of a lever 82 cooperate, the hub of the latter being rotatably supported by the part 78 of the carousel body and having passing through it the said shaft 70 provided with at least one longitudinal groove 83 for keying to the corresponding cotter 84 of the said hub. In this case

also, keying between the hub of the lever 82 and the shaft 70 may be achieved in a different manner with a coupling consisting of splined shafts allowing relative movements in the axial direction. On the top end of the shaft 70, which projects inside the part 38 of the gripper body 33, there is fixed a crank 85 which, as can be seen from the detail of Figure 7, is provided with a longitudinal eyelet 86 which cooperates with the middle part with a round cross-section of a vertical pin 87 which passes through a slot 88 provided in the part 38 of the gripper body and is fixed via its top end to the horizontal stem 36 which slides inside a hole with bush 89 formed in the said part 38, which projects from the gripper body radially with respect to the carousel and which has on its end the opposition element 35. The bottom end of the pin 87 cooperates with a sliding block 90 which slides inside a guide 91 with a U-shaped profile (Fig. 8) located underneath the crank 85 and fixed to the bottom cover 40. This arrangement ensures actuation of the opposition element 35 associated with the grippers 7 for holding the flask by the body. For operation of the opposition element 35 associated with the grippers 6 for holding the flask by the neck, on the other hand, a special flute-tip front coupling, described below, is provided between the hub of the lever 82 and the associated shaft 70.

With reference to Figure 10, the filling carousel 8 is now described in detail. On a support surface 94 there is fixed the upper and flanged edge of a cup-shaped structure 95 which, with its bottom edge, supports in a coaxial position a hollow column 96 which suitably emerges from the structure 95 and which by means of end bearings 97 rotatably supports internally a coaxial tube 98 which projects by a suitable amount from the top part of the column and also from the bottom part of the latter, where it has keyed on it a toothed pulley 99 connected to a suitable driving source (see below). The tube 98, referred to below as the external tube, supports rotatably inside it, by means of end bearings 100, a tube 101, referred to below as the internal tube, which supports above the external tube a flange 102 and which supports below the said tube a toothed pulley 103. The pulleys 103 and 99 are connected to the main driving source 104 of the machine, with the arrangement in between of any suitable known device 105 which allows the two tubes to be phase-adjusted, i.e. advanced or delayed, via a driving means 106. The pulleys 99 and 103, once phase-adjustment has been performed, rotate in the same direction and at the same speed.

On the flange 102 of the internal tube there is fixed coaxially the roof of a cylindrical bell-shaped structure 107 which with its bottom edge extends to within a short distance of a tubular body 108 fixed to the structure 95 and which encloses the various internal mechanisms of the carousel. This body 108 may advantageously be composed of several parts so that it can be removed in order to facilitate any extraordinary maintenance of the carousel. On the periphery of the structure 107 there are formed the pairs of vertical and equidistant holes, containing linings 65, 66 of material with a low coefficient of friction, inside which there axially slide the tubes 63, 64 which each carry at the top a gripper body 33, as already described with reference to Figure 5. Figure 10 shows on the left-hand side the mechanism with the shaft 69 which effects opening and closing of a gripper, while on the right-hand side it shows the mechanism with the shaft 70 which modifies the position of the opposition element 35 of the grippers. The hub of the levers 77, 82 which cause oscillation of the aforementioned shafts 69, 70, is mounted via bearings, as illustrated in the detail of Figure 11 relating to the lever 77, inside an annular structure 110 arranged coaxially and fixed to the bottom edge of the bell-shaped structure 107. The rollers 81 of the levers 82 cooperate with the eyelets 111, arranged radially and angularly equidistant, of a cam 112 fixed coaxially on a middle flange of the external tube 98, illustrated in detail in Figure 12. With a variation in the size of the flasks, the driving means 106 of Figure 10 is actuated, resulting in phase-displacement of the tubes 101 and 98, such that the cam 112 rotates in the direction and with the angular displacement necessary for the position of the opposition element 35 of the grippers to be adapted to the size of the flasks.

From Figures 10 and 11 it can be seen that the hub of the levers 77 is longer than that of the levers 82 since it is surrounded by a needle spring 113 which biases the rollers 76 of the levers in question so as to adhere to the profile of a cam 114 fixed at 115 to the top of the hollow column 96 and which determines the opening and closing movement of the grippers. Considering Figure 4 again, it can be seen that opening of the grippers 7 must be advanced or delayed according to the dimensions of the flask, since this variable modifies the position of the jaws of the grippers with respect to the point of intersection 31 of the orbits 30 and 29 of the filling carousel with the following transfer carousel 10. From Figure 1 it can be seen, moreover, that the grippers of the filling carousel 8, when they cooperate with the first transfer carousel 4, must normally close in order to grip a flask, but periodically they must remain open in order to allow an empty flask to pass towards the means which transfer it subsequently to the weighing unit 24. In order to satisfy this requirement, provision has been made for that which is now described with reference to Figure 10 and the details of

Figure 13. 9 denotes the direction of rotation of the carousel 8. The fixed cam 114 cooperates with the lower roller of the pair of rollers 76 associated with each lever 77. Above the cam 114 there is provided another flat cam 117 with which the upper roller of the said rollers 76 of the levers 77 is able to cooperate and this cam is provided with a collar 118 mounted rotatably inside a corresponding seat of the fixed cam. When the upper cam 117 is rotated in an anti-clockwise direction when viewing Figure 13, the face 119 of the latter moves away from that 120 of the fixed cam, with a corresponding advance in opening of the levers 77 an the grippers 7. For rotation it is envisaged that the cam 117 should have fixed at the bottom a vertical rod 121 connected to a tie 122 with spherical joints, which in turn is articulated with the end of a right-angled lever 123 pivotably hinged at 124 laterally with the column 96 and connected at the other end to a transmission element 125 oriented for example downwards and connected to a servo control device, not shown, for example of the screw and nut type, which is electrically operated and may be remotely operated via the machine's control panel.

From Figure 13 it can be seen that when the rollers 76 of the levers 77 cooperate with the rear face 126 of the fixed cam 114, the levers themselves oscillate so as to close the grippers 7. Underneath this face 126 there is provided a segment 127 which normally is lowered and which therefore does not interfere with the said rollers 76, but which can be raised and arranged at the same height as the profile of the fixed cam, so as to form an extension of the curvature of this cam, with a consequent delay in closing of the grippers 7 when these, in cooperation with the transfer carousel 4, must remain open so as to allow an empty flask to pass by. 128 denotes the descending face of the rollers 76 in the case of activation of the segment 127. The cam segment 127 is provided with an enlarged base 129 which carries fixed at the bottom a pair of vertical rods 130 sliding in corresponding guiding seats formed in a support 131 fixed laterally at 132 to the column 96, there being fixed to this same support the body of an electromagnet 133 connected via the spindle to a cross-piece which connects to one another the bottom ends of the said rods 130 so as to raise or lower the cam segment 127.

From Figure 10 it can be seen that the flasks held by the grippers 7 of the filling carousel are raised in succession so that their mouths are able to receive the spouts 134 of the product delivery tower 135 (see below), with a travel which is designed to be constant with variation in the size of the flasks and which is the result of cooperation of the wheels 72 of the carriage 71 with an annular double-acting cam 73 coaxially arranged in the carousel and fixed on the base 95. The cam 73 of the filling carousel has a lower part 92 of its profile which prepares the grippers for taking hold of and transferring the flasks from the first and to the second transfer carousel 4, 10, and has a high profile part 93 which prepares the grippers for raising of the flasks so that the delivery spouts 134 of the tower 135 are able to penetrate inside the latter. To ensure that the spouts 134 are able to enter into the flasks of varying size by the amount required in each case, provision is made for suitable axial displacement of the tower 135.

The tower 135 with the flask filling spouts is, for example, of the type described in Italian Patent Application No. B093A 000310 in the name of the Applicant, which comprises a fixed top part 147 which has joined to it the pipes 148 connected to the metering devices separate from the carousel and to which is connected the shaft 149 coaxially arranged inside the internal tube 101 of the carousel, which may be used for angular fixing of the part 147 and which with its bottom end is connected to axial displacement means which prepare the tower 135 for use, with the spouts 134 at different heights according to the size of the flasks, or for washing and sterilisation. Purely by way of example, as illustrated in Figure 10, the tower 135 comprises a bottom part 206 which is integral with the structure 107 and which supports, with the possibility of axial displacement and rotational coupling, the top part 207 which houses the spouts 134. The shaft 149 is provided with a tapered upper section on which there rests a helical spring 208 which rests with its other end against the part 207. The said shaft 149 has a threaded bottom section 209 which cooperates with a nut 210 rotatably supported by a support 211 fixed to the frame of the machine, the said nut being provided, integrally and coaxially, with a toothed pulley 212 connected by means of the associated positive transmission 213 to a geared motor 214 which can be remotely operated via the control panel of the machine. The shaft 149 is prevented from performing rotational movements by fixing to an arm 215 which with the end slide 216 slides on a vertical slide 217 fixed to the cup-shaped element 95. With activation of the actuator 214 it is possible to displace axially the shaft 149 and therefore adjust the heightwise position of the spouts 134 to suit the size of the flasks used in each case.

Coupling between the parts 206 and 207 is such that in the maximum raised position, the part 207 comes up against a stop 218 on the said part 206 such that further raising of the shaft 149 causes compression of the spring 208 and corresponding raising of the part 147 with respect to the part 207, for washing and sterilisation of the product delivery tower.

Figure 14 shows the sealing carousel 12, also provided with grippers 7 for holding the flasks by the body, which differs from the filling carousel 8 on account of the following features. The grippers do not perform raising and lowering movements since the flasks rest on underlying supports mounted on the carousel (see below). The gripper-carrying mechanisms therefore end in the region of the hubs of the levers 77 and 82 for effecting opening and closing of the jaws and positioning of the opposition element 35.

The cam operating the levers 77 may not be provided with the segment 127 for prolonging the opening condition of the grippers, illustrated in Figures 10 and 13.

Inside the internal tube 101 there is mounted, via bearings 150, an additional tube 151 provided at the top with a flange 152 which has rigidly mounted on it vertical guiding rods 153 on which there slides the base 154 of the drum cam assembly which determines the necessary downward travel for the insertion of the stopper in each flask by the sealing units mounted on the structure 107, 110. The base 154 is integral with the top of a shaft 155 which passes axially through the said tube 151, which projects from the latter at the bottom and which with its bottom end is fixed to an arm 156 provided with a slide 157 which slides on a vertical guiding rod 158 fixed to the bottom of the base structure 95 of the sealing carousel. To another fixed point there is connected by means of the extension 159, the body of a chuck 160 which rotatably supports a nut 161 with a toothed pulley 162 connected by means of a toothed belt 163 and associated pulley to a small geared motor, not shown, which may be operated from the machine's control panel. The nut 161 cooperates with a threaded part 164 of the shaft 155 so as to effect raising of the base 154 of the cam assembly and adjustment of the heightwise position of the sealing units according to the size of the flasks being processed. In Figure 15, 165 denotes the supports on which each flask 1 is arranged during sealing. From the same figure it can be seen that, contrary to the situation in the filling carousel 8, the jaws of the grippers 7 have a fork-shaped configuration as indicated by 166 and the opposition element 35 has an upper recessed configuration 167 coinciding with the opening of said jaws, i.e. in order to allow the insertion, into these openings and recesses, of a fixed extraction guide 168 which intervenes when the grippers 7 open and the flask is transferred to the unloading unit 18 shown in Figure 1.

With reference to Figure 16, a description is now provided of the transfer carousels which cooperate with the filling carousel and in particular the carousel 4 which supplies the empty flasks to the filling carousel.

The carousel 4 differs from the filling carousel 8 in Figure 10 in that it does not make provision for the cyclical raising and lowering of the gripper-carrying mechanisms. The wheels 72 of the carriages 71 of these mechanisms slide in a horizontal annular cam 73, the heightwise position may be modified to suit the size of flask being processed, by the connection to the slide 142 connected to a nut-screw assembly 143 actuated by the geared motor 169 which may be remotely activated via the machine's control panel.

Another variant relates to actuation of the levers 82 for operating the opposition elements 35 of the grippers 6. The hub of the levers 82 is freely mounted on the shaft 70 and ends at the bottom in a part 170 with a flute-tip shape which cooperates with a bush with a complementary front profile 171 keyed onto the shaft 70 by means of the cotter 84 or by means of coupling with prism-shaped shafts and pushed upwards by a spring 172 which reacts on the bottom of a lining 173 fixed to the said part 170 at the top. The parts 170, 171, 172 form a front coupling which reacts with lowering of the bush 171 when the opposition element 35 of the grippers 6 is pushed in the direction of the body 33 by the flask retained by the rigid opposition element 35 of the grippers 7 which grip it by the body, as already described with reference to Figures 2 and 4. When the flask no longer pushes against the opposition element 35, the parts 171 and 170 are coupled together again and the opposition element stops in the rest position relating to the size of flask being procesed.

Since the grippers of the first transfer carousel 4 must be able to cooperate in different opening or closing conditions with regard to the carousel of the weighing unit 24 and with regard to the feeder station 2,3, the cam which causes the opening and closing movements of the grippers 6 of this transfer carousel is different from that of the operating carousels and is now described with reference to Figures 16, 18, 19 and 20. The cam in question comprises a collar 174 which surrounds with play the external tube 98 and which has a flange 175 fixed at 176 to the top of the hollow column 96, this flange being provided, in the angular position corresponding to the filling carousel 8 and the unit 2, 3 for supplying empty flasks, with projections 177, 178 which have rigid with them, respectively, a raised portion 179 in the shape of a "T" and a raised portion 180 in the shape of an upturned "L", both having a curved form, of the same radius, centered on the carousel axis, which form two fixed cam parts with which the upper roller of the rollers 76 of the levers 77 is intended to cooperate for opening the grippers 6. In front of the first fixed cam part 179, underneath the front flange of the latter, there is provided a cam segment 181 which

has on its front face a transverse portion 182 which extends as far as the collar 174, these cam parts being integral with a base-piece 183 which carries, fixed at the bottom, a pair of vertical rods 184 sliding on an annular structure 185 mounted rotatably on the column 96, by means of the bush 186, and which is supported for example by segments 187 fixed laterally to the said column. The rods 184 are for example interconnected at their bottom end by means of a small cross-piece 188 fixed to the spindle of a small electromagnet 189 in turn fixed to the bottom flange 190 of the structure 185. Following raising performed by the electromagnet, the cam parts 182 and 181 are in the position illustrated in Figure 20 by means of continuous lines, such that they are able to be engaged by the lower of the rollers 76 of the levers 77, whereas when these same cam parts are in the lower position, as indicated by the broken lines, said cooperation does not occur.

Still with reference to Figures 18 and 19, it can be seen that, between the cam parts 179 and 180, there is provided the cam segment 191, with the same curvature 191, which at one end is positioned underneath the rear flange of the part 180 and which at the other end is integral with a cam part 192 having the same profile and the same function as that 182 and which, like the latter, is arranged transversely and extends as far as the collar 174 of the fixed cam portions. The cam parts 191 and 192 are fixed to a flat and curved base-piece 193 which extends beyond the part 192 by a certain amount and which carries, articulated on a vertical pin 194, a cam segment 195 which is positioned underneath the rear flange of the part 179 which has the same curvature and which normally rests against the end of the part 191 so as form an extension thereof. The base-piece 193 is also provided so as to be rigid with a pair of vertical and lower rods 196 which pass slidably through the annular structure 185 and which are interconnected at the bottom by a cross-piece 197 fixed to the spindle of an electromagnet 198 integral with the flange 190 of the said annular structure. When the assembly of cams 191, 192, 195 is in the raised position, as illustrated by continuous lines in Figure 20, the said assembly cooperates with the lower roller of the rollers 76 of the levers 77, whereas, when it is in the bottom position, as indicated by the broken lines, said cooperation does not occur.

From Figure 16 it can be seen finally that the bottom flange 190 of the annular structure 185 carries, fixed at the bottom, the rod 121 connected by means of the tie 122 to the right-angled lever 123 pivotably hinged at 124 with the hollow column 96 and connected to the actuating tie 125 which adjusts the angular position of the annular structure 185 and the cam parts 181, 182 and 191, 192, 195 mounted thereon, according to the size of the flasks being processed, so as to modify the opening phase of the grippers 6.

The mode of operation of the cam thus designed is as follows (see Figs. 1, 18, 19 and 20). In the normal condition where a flask is taken from the feeder unit 2, 3 and transferred to the filling carousel 8, both the electromagnets 189 and 198 are in the position for raising of the associated cam parts. The rollers 76 of the levers 77, in the direction of movement indicated by the arrow 5, cooperate with the cam parts 182 and 181 which cause opening of the grippers during cooperation with the filling carousel 8, following which the rollers travel externally on the parts 179, 195, 191 and 180 and, upon leaving this last cam part, move towards the carousel axis, causing the grippers to close when the latter cooperate with the feeder apparatus, 2, 3, in order to grip an empty flask. When an empty flask must be transferred to the carousel of the weighing unit 24, so that the gripper 6 must open only when opposite this carousel, the first cam parts 181, 182 will be in the bottom position, as indicated by the broken lines in Figure 20. The gripper involved in this operation remains closed until the rollers 76 of the associated lever 77 enter into cooperation with the cam part 192, causing opening of the oscillating part 195, as shown in broken lines in Figure 20, following which the said rollers travel up onto the part 191 and then continue along the cam part 180. When the rollers 76 travel up onto the cam part 191, the gripper is completely open and closes again when the said rollers leave the cam part 180 and the said gripper cooperates with the unit 2, 3 supplying an empty flask.

When the empty and weighed flask must be returned to the transfer carousel 4, the pick-up gripper 6 must close during cooperation with the gripper 7 of the carousel of the first weighing unit 24. In this case the set of cams 191, 192, 195 is in the bottom position. The rollers 76 of the lever 77 of the gripper 6 performing gripping of the weighed flask cooperate normally with the cam parts 182, 181, 179 and, upon leaving this last cam part, closure of the gripper commences, the latter gripping the flask released in a synchronised manner by the said carousel of the unit 24.

The second transfer carousel 10 differs from the carousel previously considered exclusively on account of the cam which performs closing and opening of the grippers 6. The grippers of this carousel must in fact modify their operation only with regard to the carousel of the weighing unit 28. The cam in question, as illustrated in Figures 21 and 22, differs from the one already considered with reference to Figures 18, 19 and 20, not only on account of obvious dimensional requirements,

but also with regard to the following features.

The base-piece 193 with the cam parts 191, 192 is fixed to the annular structure 185. Immediately upstream of the cam part 195, performing a transfer function, there is provided a cam segment 200 with an end portion 201 which extends towards the carousel axis. The base-piece 199 which supports the assembly 200, 201 is fixed to a pair of vertical rods 202 which slide, guided, through the upper collar of the annular structure 185 and which, at the bottom end, are fixed to a cross-piece 203 connected to the spindle of an electromagnet 204 fixed to the bottom collar 190 of the said structure 185. When the cam parts 200, 201 are raised, the lower roller of the rollers 76 of the levers 77 of the carousel 10 cooperates with them. The parts 200, 201 are positioned at the correct distance from the fixed cam part 179 which now has the configuration of an upturned "L".

From Figures 1, 21 and 22 it can be seen that when the transfer carousel 10 must transfer the flasks normally to the sealing carousel 12 and then must remove the flasks from the filling carousel 8, the mobile mechanisms of the electromagnets 189 and 204 are both lowered so that the rollers 76 of the levers 77, which rotate in the direction indicated by the arrow 11, cooperate exclusively with the cam part 192 which causes opening of the grippers 6 during cooperation with the grippers 7 of the sealing carousel, after which the said rollers cooperate with the cam parts 191 and 180 which keep the grippers open until cooperation with the grippers 7 of the filling carousel. Here, the rollers 76 leave the cam part 180 and the associated grippers 6 of the transfer carousel close in order to grip a flask. During this phase the oscillating part 195 of the cam opens in the position indicated in Figure 22 by broken lines.

When the transfer carousel 10 has to transfer a flask to the carousel of the weighing unit 28, the cam parts 200, 201 are raised. The gripper 6 of the carousel 10 enters closed into cooperation with the open gripper 7 of the weighing unit, after which the rollers 76 of the lever 77 concerned begin to cooperate with the cam part 201 which causes opening of the gripper which remains open during subsequent cooperation with the part 201 and then with the part 195. The gripper 6 travels past the sealing carousel in the open condition and then performs the normal closing cycle during cooperation with the filling carousel 8. In this way closing of the grippers 6 in the empty condition is avoided, thereby protecting them from undesired stresses. When, on the other hand, the transfer carousel 10 has to pick up a flask from the carousel of the weighing unit 28, the cam parts 181, 182 are raised, while the cam parts 200, 201 are lowered. The rollers 76 of the lever 77 of the pick-up gripper cooperate with the cam part 182 which opens the gripper 6 and brings it in the open condition into cooperation with the gripper 7 of the carousel of the weighing unit 28, after which the said rollers cooperate with the cam parts 181 and 179 and, upon leaving the latter, move towards the carousel axis and close the gripper which grips the weighed flask. The arrow 205 indicates the advancing or delaying adjustment which may be made to the cam parts which cause opening of the grippers, with rotation, in both directions, of the annular structure 185 connected to the lever 123 of Figure 16.

Claims

1. Automatic machine for filling and closing flasks or other containers, of the type which comprises means (2, 3) for supplying the flasks (1) in single file, one at a time and in a synchronised manner, to a first transfer carousel (4) which in turn supplies a filling carousel (8) which transfers the filled flasks to a following transfer carousel (10) which passes them on to a sealing carousel (12) which finally transfers them to means (18, 19, 20) for transporting and conveying them away in a single file and for sorting, where necessary, the correctly filled and sealed flasks from those which are not correctly filled and/or sealed, and of the type which comprises small carousels (21, 25) which cooperate with the first and with the second transfer carousel and with respective weighing units (24, 28) for recording, with a progressive weighing and sampling system and with the cyclical formation of unfilled spaces in the supply of the flasks to the first transfer carousel, first the tare weight of the flasks and then the gross weight of the said flasks, and for then recording, by means of processing, the weight of the product delivered by each operating station of the filling carousel, characterized in that all the carousels are provided with grippers for the positive gripping of the flasks, so that the machine is able to handle a wide range of sizes of flasks without it being necessary to replace the components, but by means of simple adjustments which can be easily automated, a carousel with neck-holding grippers (6) being followed by a carousel with body-holding grippers (7), and so on, and the operating carousels, i.e. the filling carousel (8) and the sealing carousel (12), being preferably provided with grippers (7) for holding the flasks by their body, so as to leave the mouth of the flasks completely free for the action of the carousel operating means and better able to be protected from any flow of cleaning or sterilising gas which affects in a

known manner the entire machine when the latter is used for packaging medicinal or other products which require such protection.

2. Automatic machine according to Claim 1, in which the orbits (29, 30) along which the flasks of each pair of successive carousels move suitably intersect one another, the grippers of the various carousels being provided respectively with a pair of jaws with a symmetrical opening and closing movement with respect to an ideal vertical mid-plane which is fixed and radially arranged with respect to the carousel, there being provided on this plane, at a distance from the end of the grippers which varies according to the variation in size of the flasks being processed, a vertical opposition element (35) with a profile which is concave towards the outside of the carousel, for example V-shaped and integral with a slide (36) supported by the gripper body (33), and there being provided means such that when a flask travels along the said intersecting trajectories of two consecutive carousels, the flask itself is simultaneously imprisoned between the opposition element of the closed gripper which must release it and the opposition element of the open gripper which must grip it and such that the opposition elements of the grippers of a carousel are movable against the action of suitable elastic means, in order to react to the intersecting of the orbits without damaging the flask in any way and to ensure that the gripping force of the opposition elements is firm and allows the grippers to perform the necessary opening and closing movements during transfer of the flask from one carousel to another.

3. Automatic machine according to the preceding claims, characterized in that the filling carousel (8), the sealing carousel (12) and the small carousels (21-22, 25-26) associated with the weighing units (24, 28), provided with grippers (7) for holding the flasks by their body, are provided with opposition elements (35) which, after being positioned according to the size of the flask being processed, remain immobile, while the opposition elements of the grippers (6) of the transfer carousels (4, 10), which grip the flasks by the neck, are provided with opposition elements movable against the action of elastic means which tend to bring them back into the position assumed in each case for the size of flask being processed.

4. Machine according to the preceding claims, in which the grippers (7) for holding the flasks by their body, are provided with a pair of flat jaws, positioned edgewise, hinged on vertical axes and provided with an end section (34) bent inwards, if necessary lined with shock-resistant material, so as to perform gripping of the body of the flask over portions situated outside the orbit (30) along which the axis of the flask itself moves, the latter thus being pushed by the jaws in the direction of the vertical and immobile opposition element (35) of the gripper, assuming a stable and absolutely precise position.

5. Machine according to the preceding claims, in which the grippers (6) for holding the flasks by their neck are provided with a pair of jaws hinged on vertical axes and with flat, horizontal, end parts provided on their inner side and at their ends, with a respective concave portion (37) with a profile in plan view in the form of a very open V, which is suitable for holding the necks of flasks of varying diameter, the vertical opposition element (35) of these grippers being located entirely underneath the latter and having a height such that it has a section of itself opposite and at the same height as a section of the opposition element of the body-holding grippers (7), when the two different grippers of two consecutive carousels cooperate with each other in order to transfer a flask from one carousel to the other.

6. Machine according to the preceding claims, in which each gripper comprises a composite body (33) fixed to the top of a pair of vertical tubes (63, 64) which slide in an axially guided manner, in suitable seats (65, 66) of the body (107) of the carousel and in which there are mounted coaxially and rotatably respective shafts (69, 70) which project at the bottom from said tubes and which are fixed at their bottom end onto the body of a carriage (71) which via its wheels (72) slides in an annular, static, double-acting cam (73) which determines the heightwise position of the grippers, the said shafts passing, in a keyed condition, but with the possibility of axial displacement, for example via a splined shaft coupling or a cotter-type keying, through the hubs of respective levers (77, 82) rotatably supported by the carousel body and these levers being provided with rollers (76, 81) which trace the profile of respective fixed and partially adjustable cams located on the carousel axis, one of the said shafts (69) transmitting the movement to one of a pair of hollow spindles (43, 44) which are rotatably located in the gripper body, are open at the top of the latter and kinematically con-

nected together by a pair of toothed segments (61, 62) located in the internal and upper part of the gripper body and which spindles have inserted and keyed inside them, with the possibility of rapid replacement, the shanks (53, 54) of the heads (51, 52) which carry the jaws of each gripper, and finally the other of the said shafts (70) being keyed inside the gripper body to a lever (85) provided with a longitudinal eyelet (86) through which a vertical pin (87) passes, the latter also passing through a radial eyelet of the gripper body and at one end being fixed to the slide (36) which carries the middle opposition element (35) of the gripper, the other end of this pin being integral with a sliding block (90) which slides guided inside a suitable guide (91) fixed in the gripper body.

7. Machine according to the preceding claims, in which, in the transfer carousels (4, 10), the hub of the levers (82) which control the position of the vertical opposition elements (35) of the grippers (6) for holding the flasks by their neck, has rotatably passing through it the shaft (70) which actuates the said opposition elements and this hub has a bottom end in the form of a flute tip (170) which cooperates with the complementary front face of a bush (171) keyed to the said shaft and biased upwards by a spring (172) accommodated in a housing (173) fixed to the said hub, all of which in a manner so as to provide the said opposition elements of the grippers with the spring loading which they require for operation and the necessary positioning stability in the rest condition for the size of flask being processed.

8. Machine according to the preceding claims, in which the shanks (53, 54) of the heads (51, 52) which carry the jaws of the grippers are provided with annular recesses (57, 58) designed to be snap-engaged by respective spring-loaded spheres (55, 56) which partly project laterally into the seats of the hollow spindles (43, 44) accommodating the said shanks which are provided with a top part (49, 50) with a prism-shaped cross-section inserted in an upper portion with a matching cross-section (47, 48) of the said seats of the hollow shafts, all of which being provided in order to simplify replacement of the grippers when the machine is to be set up for handling a wide range of sizes of flasks.

9. Machine according to the preceding claims, in which each carousel of the machine comprises a vertical and hollow column (96) which supports at the top the cam for opening and closing the grippers and which is fixed at the bottom to the base of a cup-shaped structure (95) flanged onto a horizontal support structure (94), there being rotatably mounted in the said column, via bearings (97), a tube (98) which has rotatably inside it an additional tube (101) and these tubes both project at the bottom from the said column and from the corresponding cup-shaped support and are connected by means of respective positive-movement transmissions (99, 103) to the driving source (104) which activates all the carousels of the machine, with the arrangement in between of a phase variator (105), the top of the said internal tube (101) having fixed to it the body (107) of the carousel with all the parts which must rotate in combination with the carousel itself, while the external tube (98) has keyed onto it the cam (112) inside the eyelets (111) of which, located more or less radially, there cooperate the rollers (81) of the levers (82) which operate the shafts (70) which effect the variations in position of the vertical opposition elements (35) of the grippers in accordance with the variation in the size of the flasks being processed.

10. Machine according to the preceding claims, in which the levers (77) which effect the opening and closing movement of the flask-holding grippers are biased by a needle spring (113) towards the carousel axis, for the corresponding closure of the grippers themselves, the rollers (76) of these levers cooperating with a single-acting cam which for the filling carousel (8) and the sealing carousel (12) is composed of a flat part (114) fixed onto the hollow support column (96) of the carousel and of another flat part (117) located above the fixed part, which has the same external profile, which is mounted rotatably about the carousel axis and which with its front face (119) forms the ascending face of the composite cam in question, the angular position of which is designed to be variable in accordance with the size of the flasks, for this purpose the said mobile cam part being connected to transmission and lever systems (121, 122, 123, 124 and 125) which are partly pivotably hinged laterally with the hollow support column of the carousel and which cooperate with servo control devices connected to the machine's control panel.

11. Machine according to the preceding claims, in which the cam which effects the opening and closing movement of the grippers in the filling carousel (8) is provided immediately downstream of the descending face (126) of the

fixed part (114) with a segment (127) which may be raised and brought to the same level as the fixed part, in order to prolong opening of the gripper levers when they are not required to remove the flask of the first transfer carousel (4) which must bring the flask towards the carousel of the first weighing unit (24), while the said cam segment is normally lowered when the grippers must close in order to grip the flask, whereby for this purpose the mobile cam segment is mounted on a pair of vertical rods (130) supported slidably by a support (131) which is fixed laterally to the hollow support column (96) of the carousel and onto which there is flanged the body of an electromagnet (133) which with its moving part is fixed to a small cross-piece integral with the bottom end of the said rods.

12. Machine according to the preceding claims, in which the cam which effects the opening and closing movement of the grippers in the first transfer carousel (4) comprises a part fixed to the top of the hollow support column (96) of the carousel itself, which carries two segments (179, 181) having the same external curvature, suitable for effecting opening of the grippers, a segment (179) being provided for example with a T-shaped lateral profile, while the other segment has for example a lateral profile in the form of an upturned "L", there being provided underneath the front flange of the said first fixed cam segment, a cam segment (181) having the same curvature, with a front portion (182) located transversely and oriented towards the carousel axis so as to form a first ascending face and these cam parts being integral with a base-piece (183) fixed to means which can be operated so as to rotate it in both directions about the carousel axis by an amount proportional to the size of the flasks being processed and to means which are able to raise it or lower it such that when these said cam parts are raised and the rollers (76) of the gripper operating levers (77) cooperate with them, the said grippers of the transfer carousel open opposite the filling carousel so as to transfer a flask to the latter, while if the said cam parts are lowered, the grippers of the transfer carousel travel past the filling carousel in the closed condition, there being provided underneath the rear flange of the first fixed cam segment (179) a small cam segment (195) which has the same curvature and which is hinged about a vertical pin (194) integral with a base-piece (193) which is also capable of adjustment with rotation about the carousel axis in accordance with the size of the flasks being processed and which may be operated so as to be raised or lowered, there being provided on this integral base-piece an additional cam segment (191) which has the same curvature as the said oscillating segment (195), facing which it has a cam portion (192) directed towards the carousel axis, which, when the said base-piece is raised, causes opening of the grippers opposite the unit for removing the flask for weighing, if the grippers arrive in the closed condition, whereas if the grippers arrive in the open condition, the grippers themselves are kept open until they leave the last fixed cam segment (180) whereupon the grippers themselves close in cooperation with the station (2, 3) supplying the empty flasks, the base-piece, on the other hand, being lowered when the grippers open in cooperation with the filling carousel (8) and close when they leave the rear flange of the first fixed cam segment (179), in order to grip the flask from the carousel of the first weighing unit (24).

13. Machine according to the preceding claims, in which the cam which effects the opening and closing movement of the grippers of the second transfer carousel (10) comprises a fixed part on the top of the hollow support column (96) of the carousel itself, which is provided with two segments (179, 181) having the same external curvature, suitable for opening the grippers and having for example both a lateral profile in the form of an upturned "L", there being provided underneath the front flange of the said first fixed cam segment, a cam segment having the same curvature (181) with a front portion (182) directed transversely towards the carousel axis so as to form a first ascending face, these cam parts being integral with a base-piece (183) supported by means which may be operated so as to rotate the latter in both directions about the carousel axis by an amount proportional to the size of the flasks being processed, and by means which are able to raise it or lower it such that when these said cam parts are raised and the rollers (76) of the levers (77) operating the grippers cooperate with them, the gripper of the transfer carousel opens before entering into cooperation with the carousel of the second weighing unit (28) in order to remove from the latter the weighed flask which is retained by the gripper of the transfer carousel upon leaving the first fixed cam segment, while if the said cam parts are lowered, the grippers of the transfer carousel travel past the carousel of the second weighing unit (28) in the closed condition,

there being provided at a suitable distance from the first fixed cam segment (179) a small cam segment (195) which has the same curvature as the preceding segments and which is hinged about a vertical pin (194) integral with a base-peice (193) which is fixed to the said means which adjust the angular position of the first cam parts, those movable heightwise, there being provided on this base-piece, integral therewith, an additional cam segment (191) which at one end is arranged underneath the rear flange of the last fixed cam segment (180) and which has the same radius of curvature as the said oscillating segment (195), facing which it has, integral therewith, a cam portion (192) oriented towards the carousel axis, which effects opening of the grippers when the latter, in the closed condition, enter into cooperation with the sealing carousel (12), there being provided immediately upstream of the said oscillating cam segment (195) a cam segment (200) which has the same external curvature and which is provided on the front end with a cam portion (201) oriented transversely towards the carousel axis and these cam parts being integral with a base-piece (199) mounted on the said means which adjust the angular position of the other cam parts and which may be raised or lowered by other means, whereby, when these cam parts are raised, the gripper which cooperates with them opens during cooperation with the carousel of the second weighing unit (28) so as to transfer to the latter a flask to be weighed, after which this gripper remains open until it is opposite the filling carousel (8).

14. Machine according to Claims 12 and 13, in which the cam parts whose angular position must be modified according to the variation in size of the flasks are mounted on an annular structure (185) in turn mounted rotatably in the top lateral part of the hollow column (96) which rotatably supports the carousel and this structure being connected by means of transmissions and levers (121, 122, 123, 124 and 125) partly supported by the said hollow column, to a servo control device which may be operated via the control panel of the machine, the cam parts whose heightwise position must be adjusted being mounted on the said annular structure by means of suitable vertical guides (184, 196, 202) and being connected to respective actuating electromagnets (189, 198, 204) fixed via their body to this said annular structure.

15. Machine according to the preceding claims, in which, in the two transfer carousels (4, 10), the wheels (72) of the carriage (71) of each gripper-carrying mechanism slide on the facing tracks of a horizontal double-acting annular cam (73), coaxial with the carousel, whose heightwise position can be modified according to the variation in size of the flasks being processed, via screw-nut means (142, 143) and a servo control device (169) connected to the control panel of the machine.

16. Machine according to the preceding claims, in which in the filling carousel (8) the wheels (72) of the carriages (71) of the gripper-carrying mechanisms travel on the facing tracks of an annular double-acting cam (73), located coaxially with respect to the carousel and fixed to the base supporting the carousel itself, the profile of which is provided with a lower part (92) for bringing the grippers (7) into cooperation with the transfer carousels (4, 10) and is provided with an upper part (93) for bringing the grippers (7) into the raised position so that the flasks of varying size are able to cooperate with the spouts (134) of the product delivery tower (135).

17. Machine according to Claim 16, in which the filling carousel (8) is provided with means for centralised adjustment of the heightwise position of the product delivery spouts (134) according to the variation in size of the flasks being processed, these means being provided with a shaft (149) coaxially arranged in the said carousel and connected at the bottom to a servo control device (209, 210, 211, 212, 213, 214, 215, 216, 217) which may be remotely operated via the control panel of the machine.

18. Machine according to the preceding claims, in which the gripper-carrying mechanisms of the sealing carousel (12) are supported by the said carousel without the need for adjustment of the heightwise position of the grippers, which remains fixed, since with a variation in the size of the flasks being processed, the heightwise position of the operating heads of the carousel which performs sealing of the flasks is varied, whereby, for this purpose, the structure (154) for supporting the drum cam which determines the heightwise position of these heads cooperates with suitable vertical guiding rods (153) fixed onto a horizontal flat element (152) supported by the top of a tube (151) which passes rotatably through the internal tube (101) which supports the carousel and which has passing through it axially a shaft (155) the bottom pro-

jecting emd of which is fixed to an arm (156) sliding by means of a bush (157) on a vertical guiding rod (158) fixed to the base of the machine, a bottom section of the said shaft being threaded and cooperating with a nut (161) which is supported rotatably by a chuck (160) with a fixed body and which can be rotated remotely via a positive-movement transmission (162, 163) and a servo control device connected to the control panel of the machine.

19. Machine according to the preceding claims, in which the sealing carousel is provided with means (165) on which the flasks transferred to it rest, the jaws of the grippers (7) of this carousel and the associated vertical opposition element (35) being provided with respective fork-shaped elements (166, 167) open towards the outside of the carousel, into which there can be inserted a fixed guide (168) for extracting and conveying away for unloading the flasks sealed by the carousel in question.

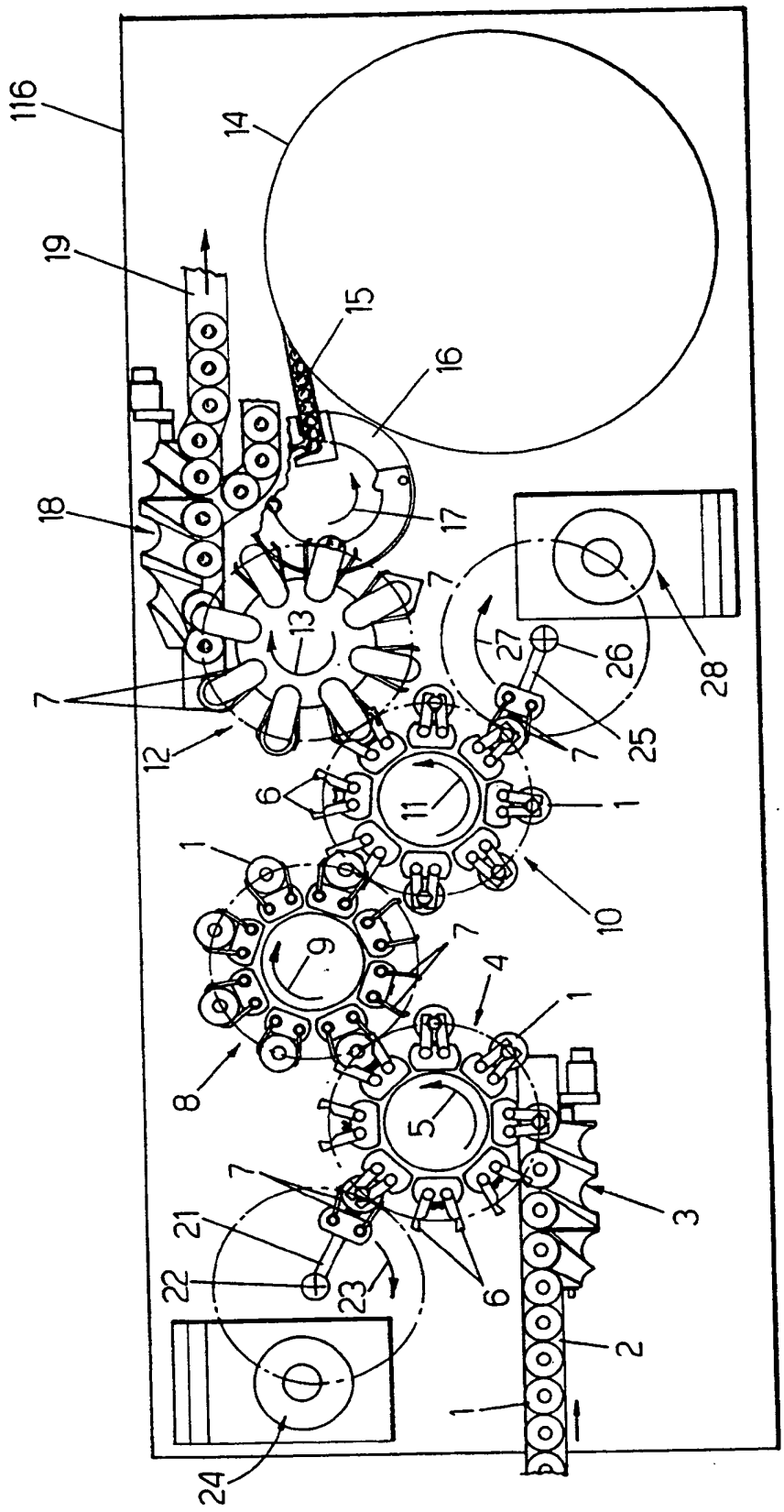


Fig. 1

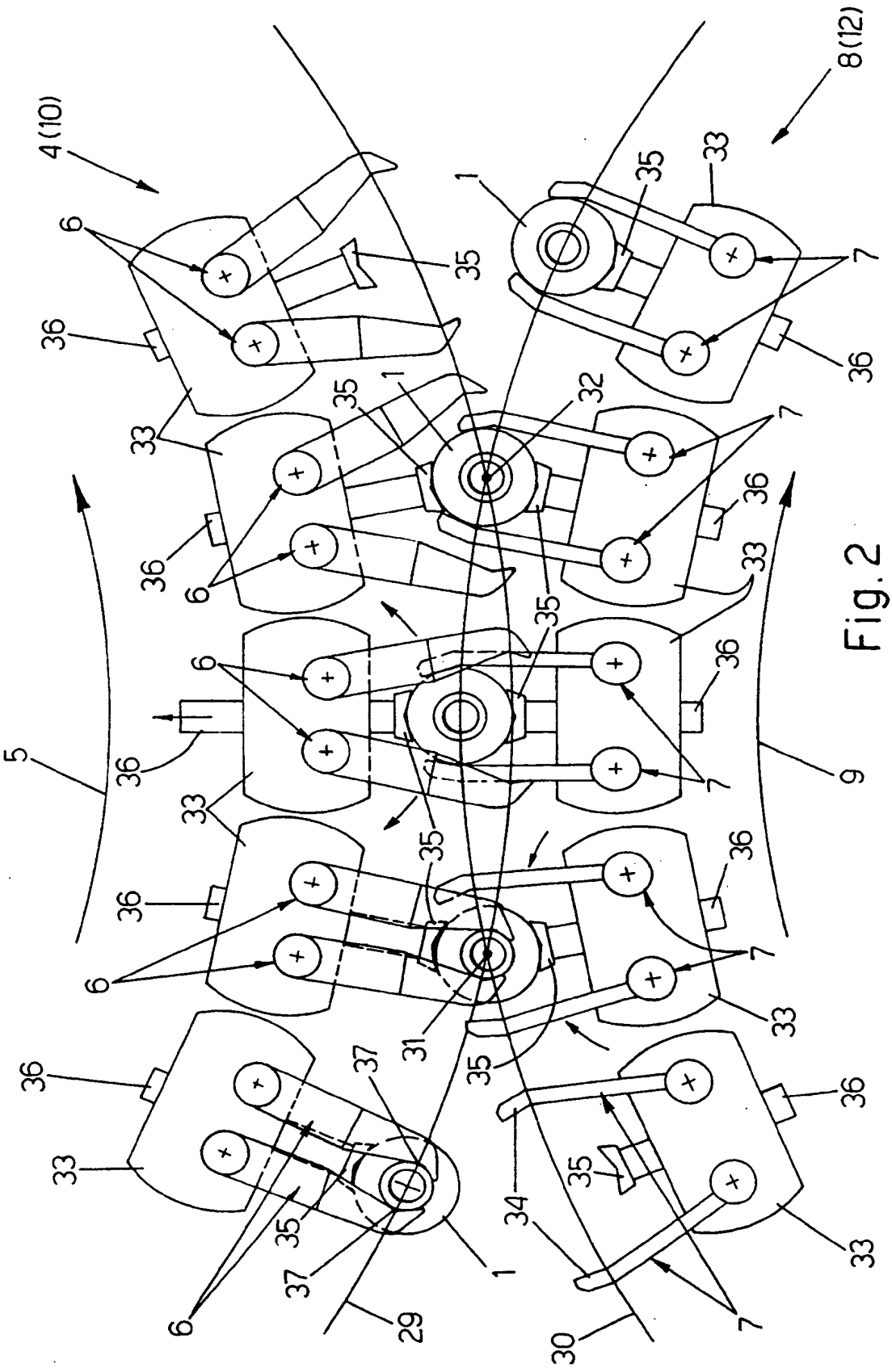


Fig. 2

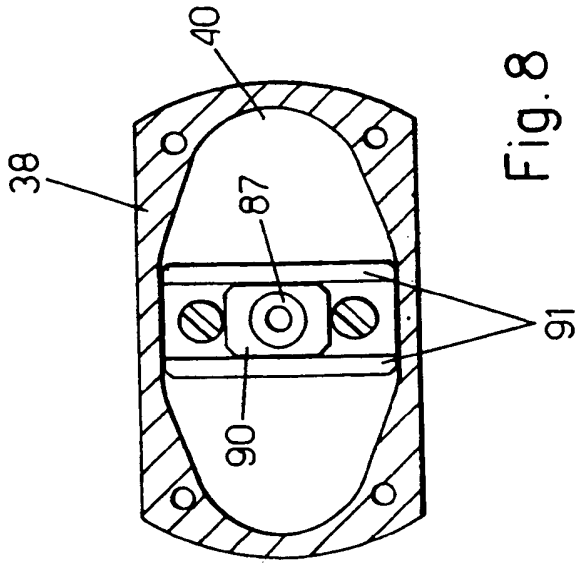


Fig. 8

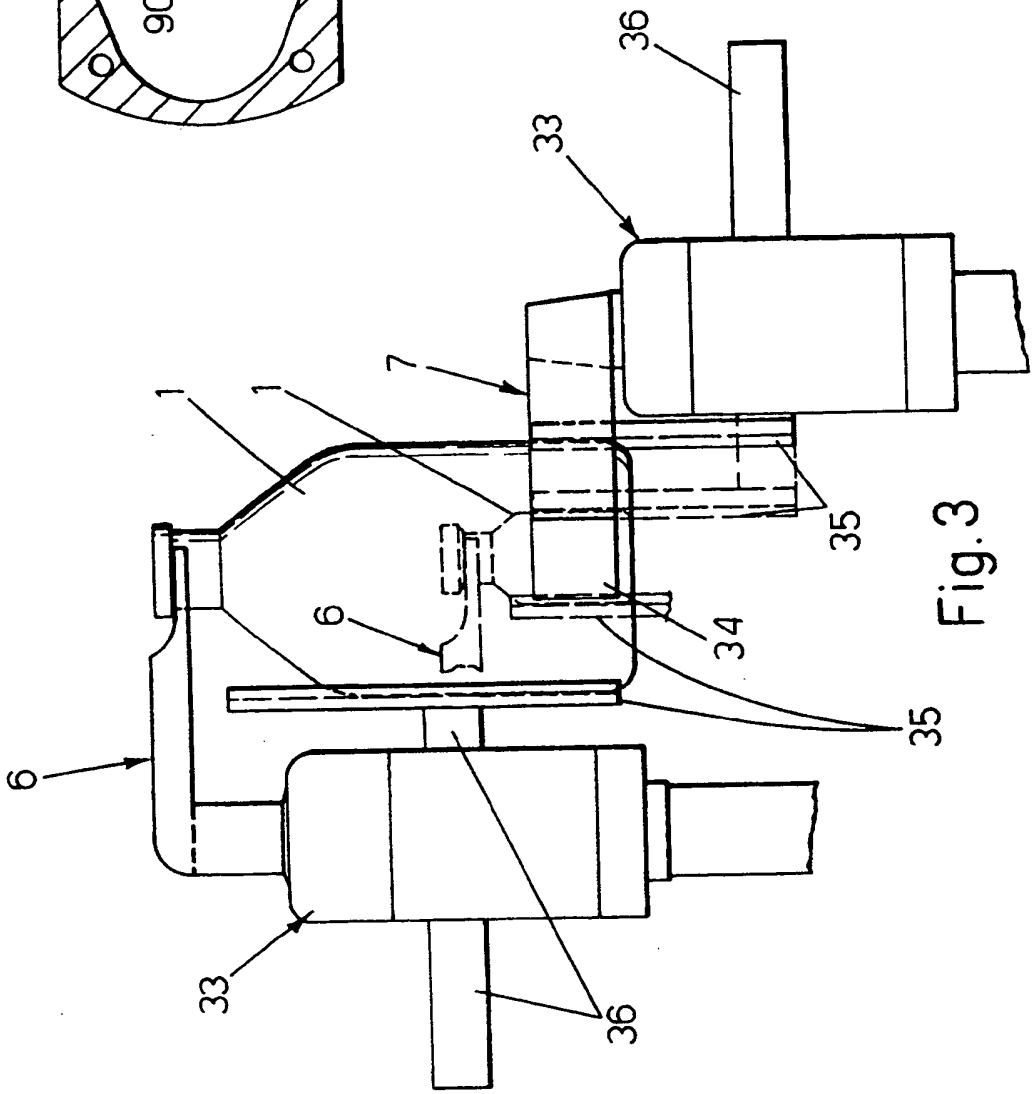


Fig. 3

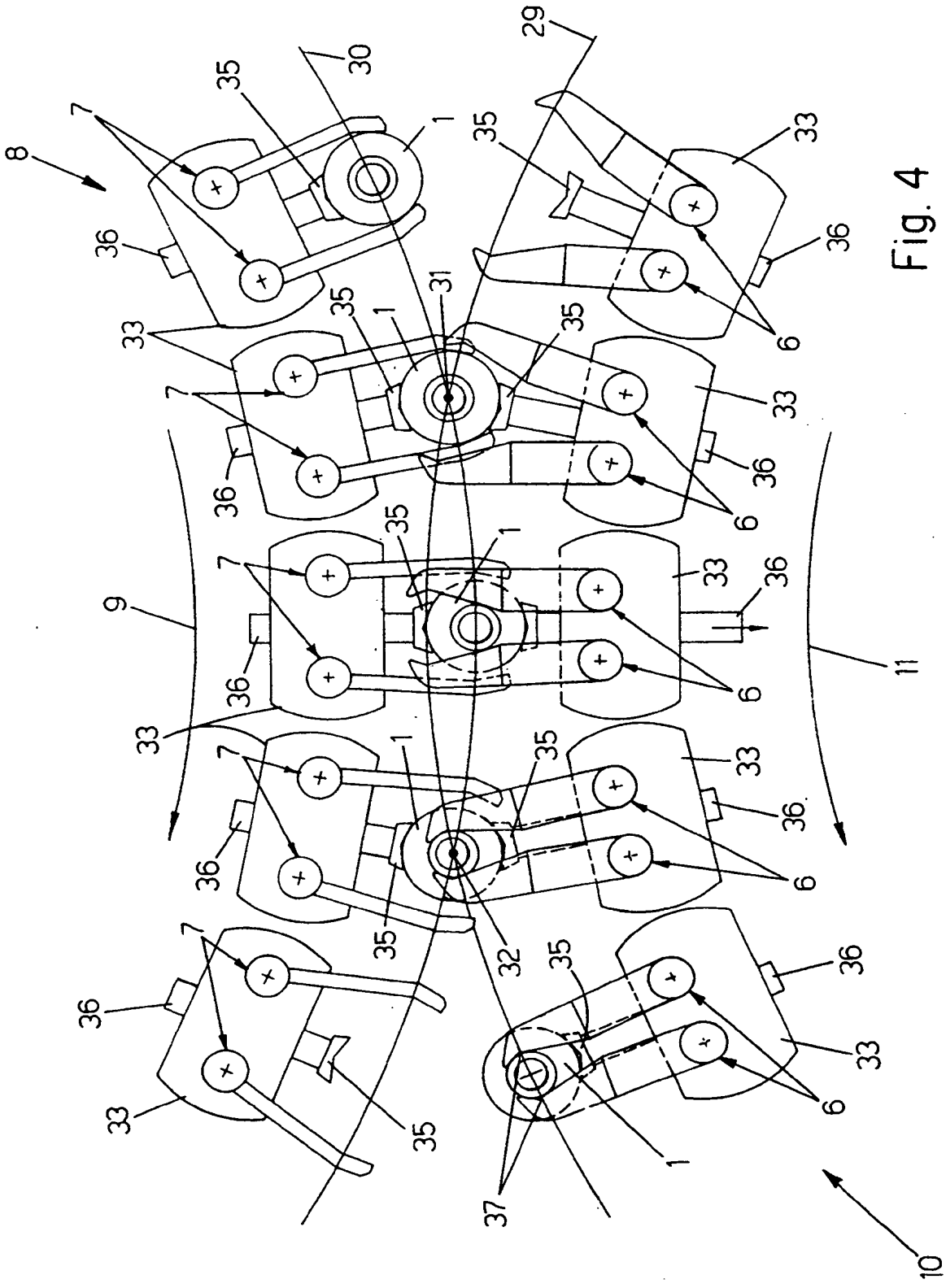


Fig. 4

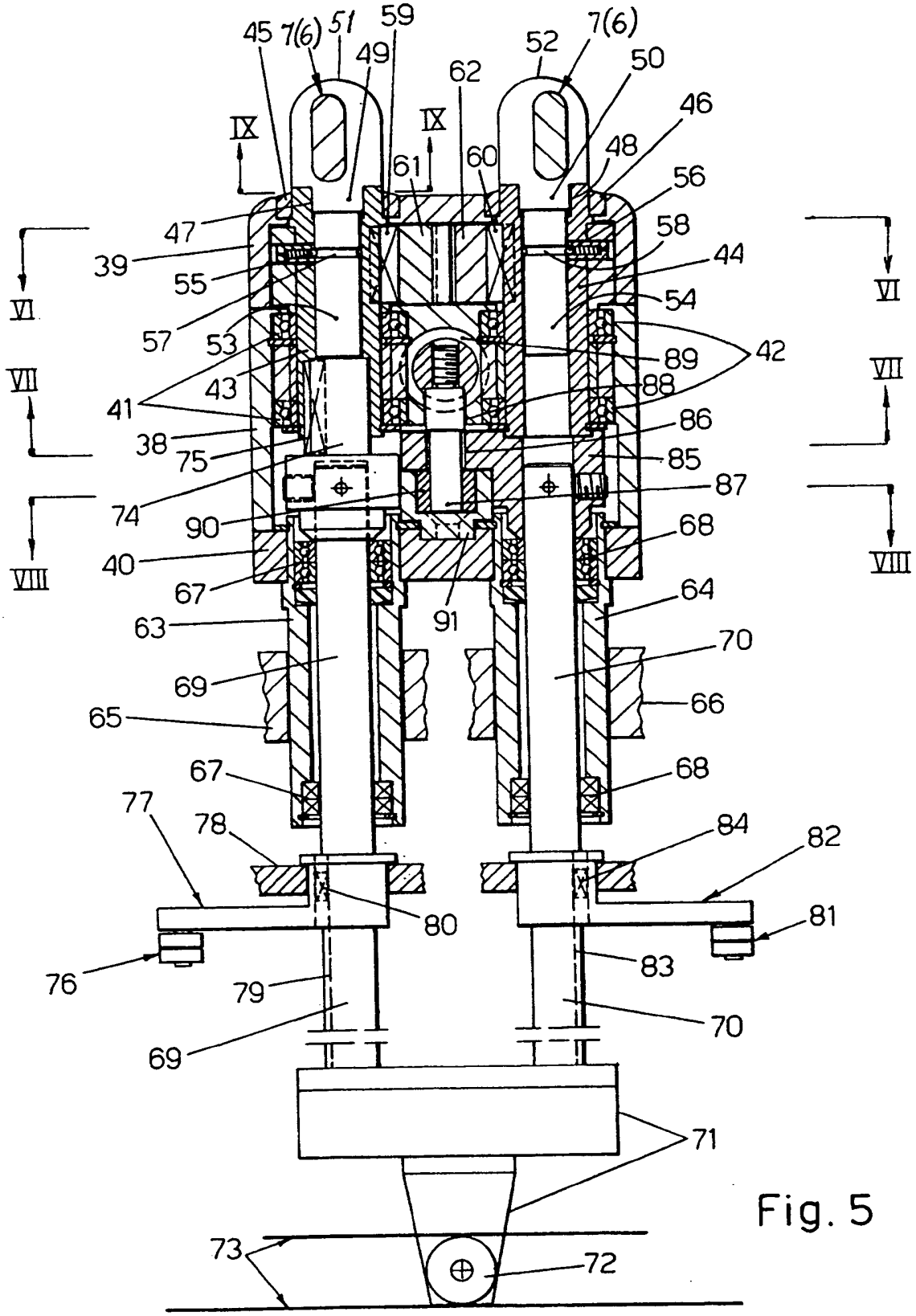


Fig. 5

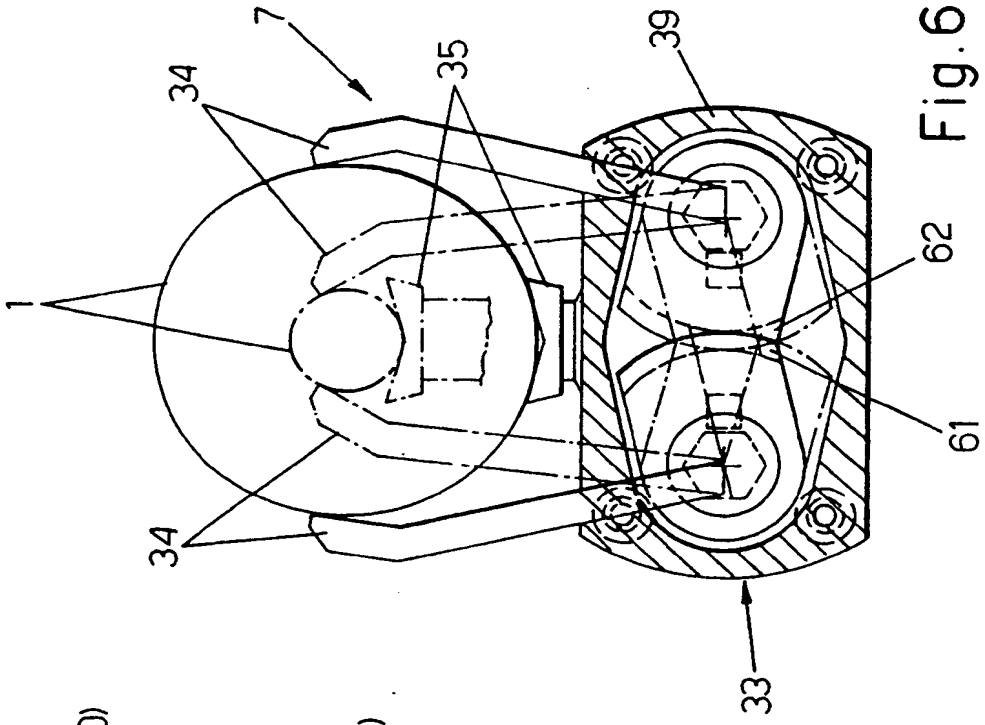


Fig.6

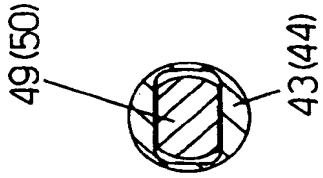


Fig.9

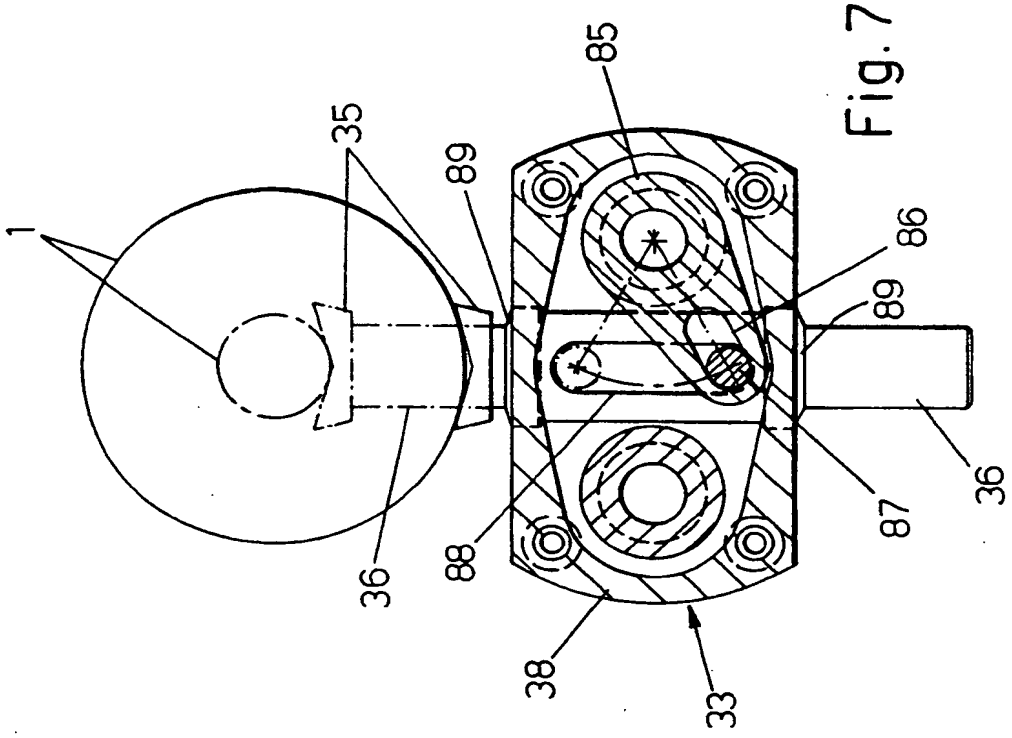
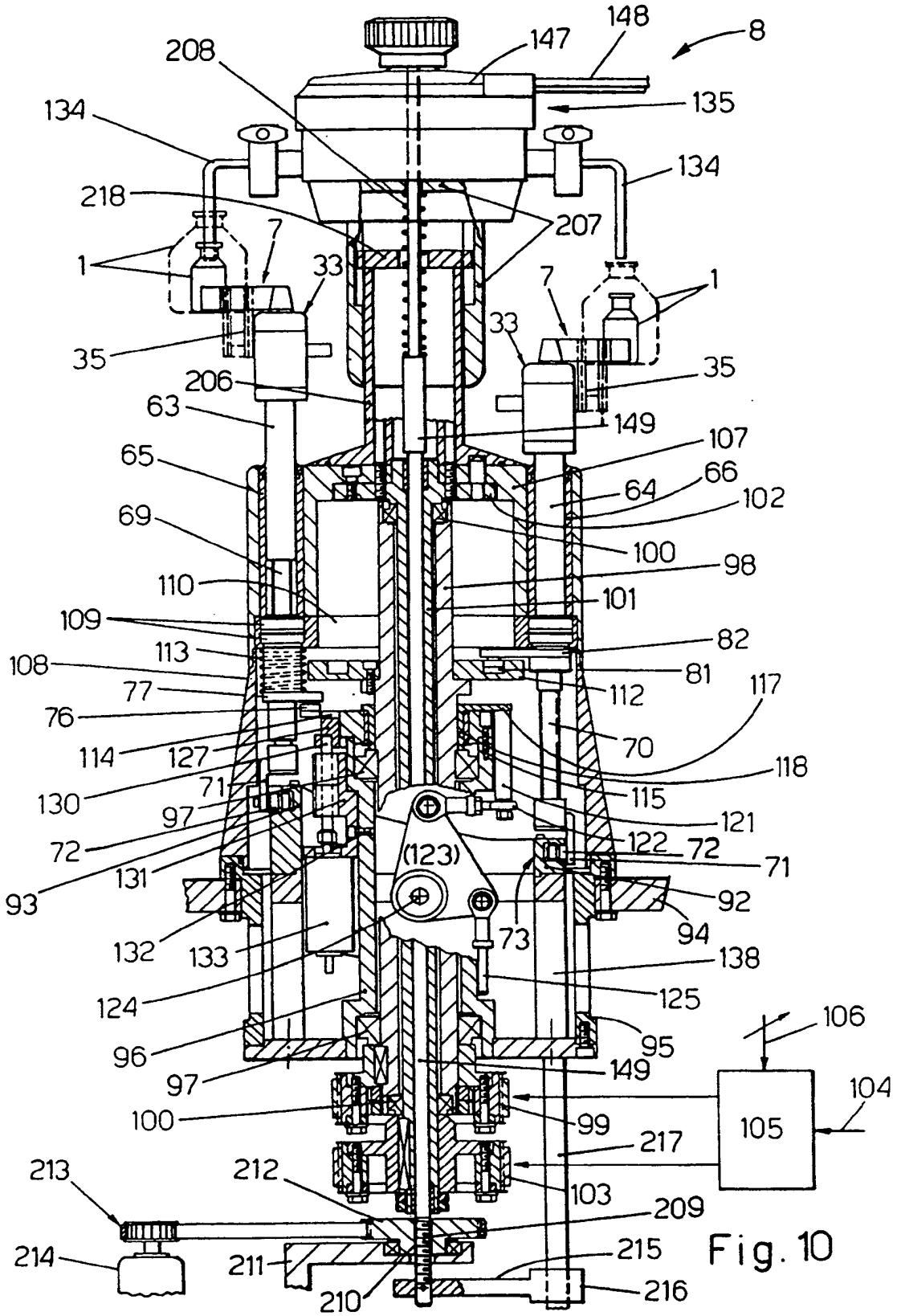


Fig.7



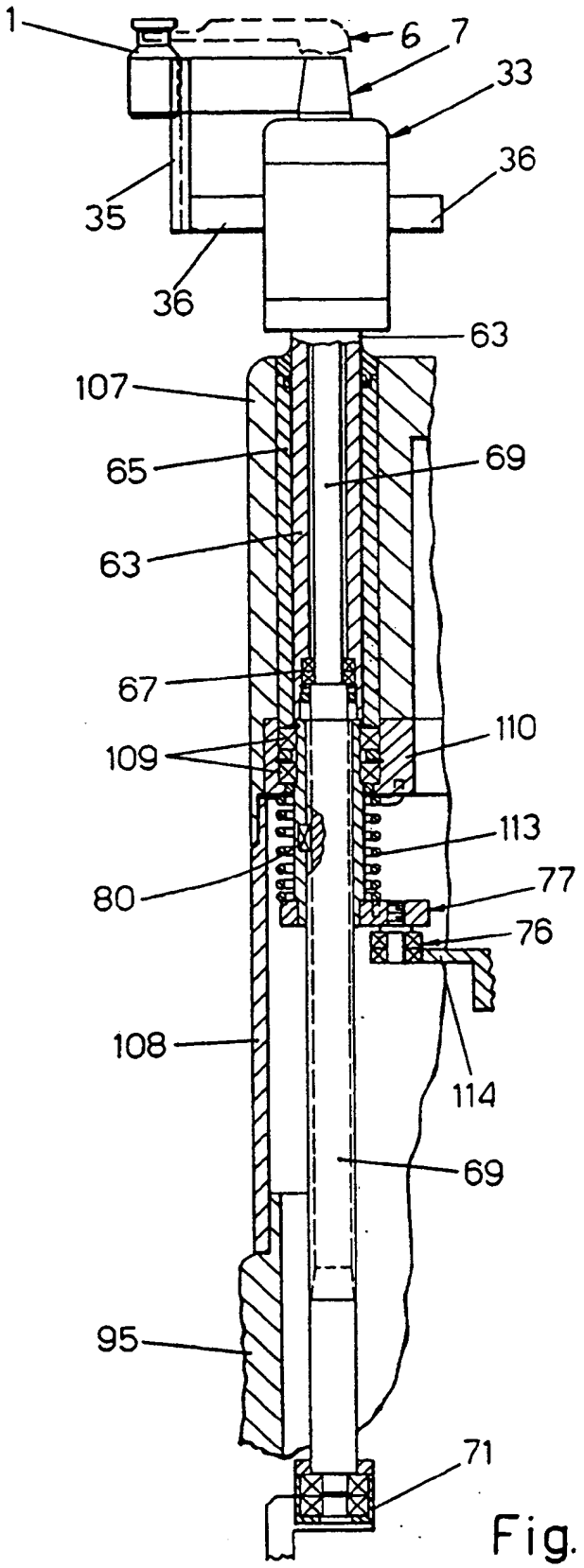


Fig. 11

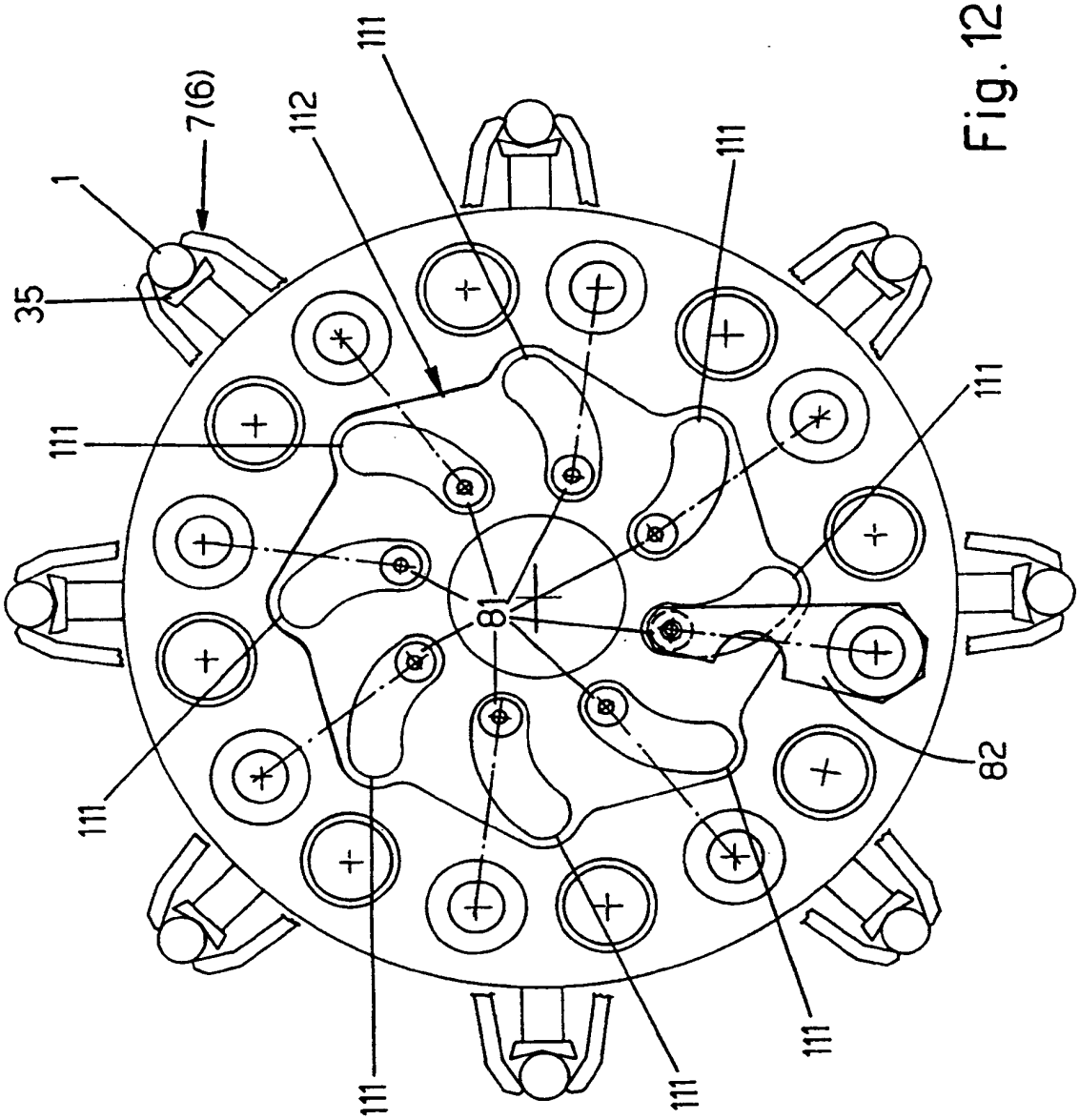


Fig. 12

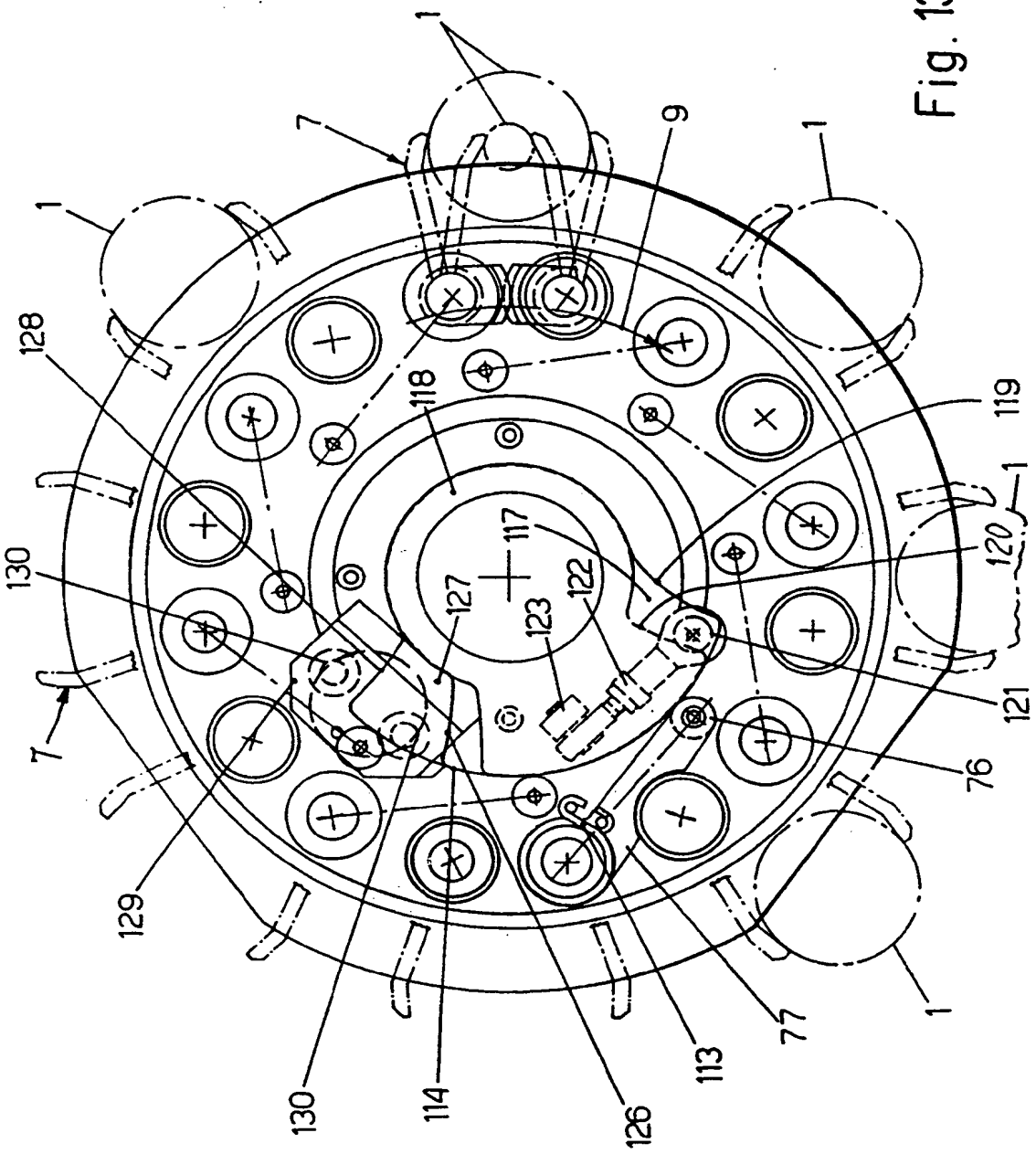


Fig. 13

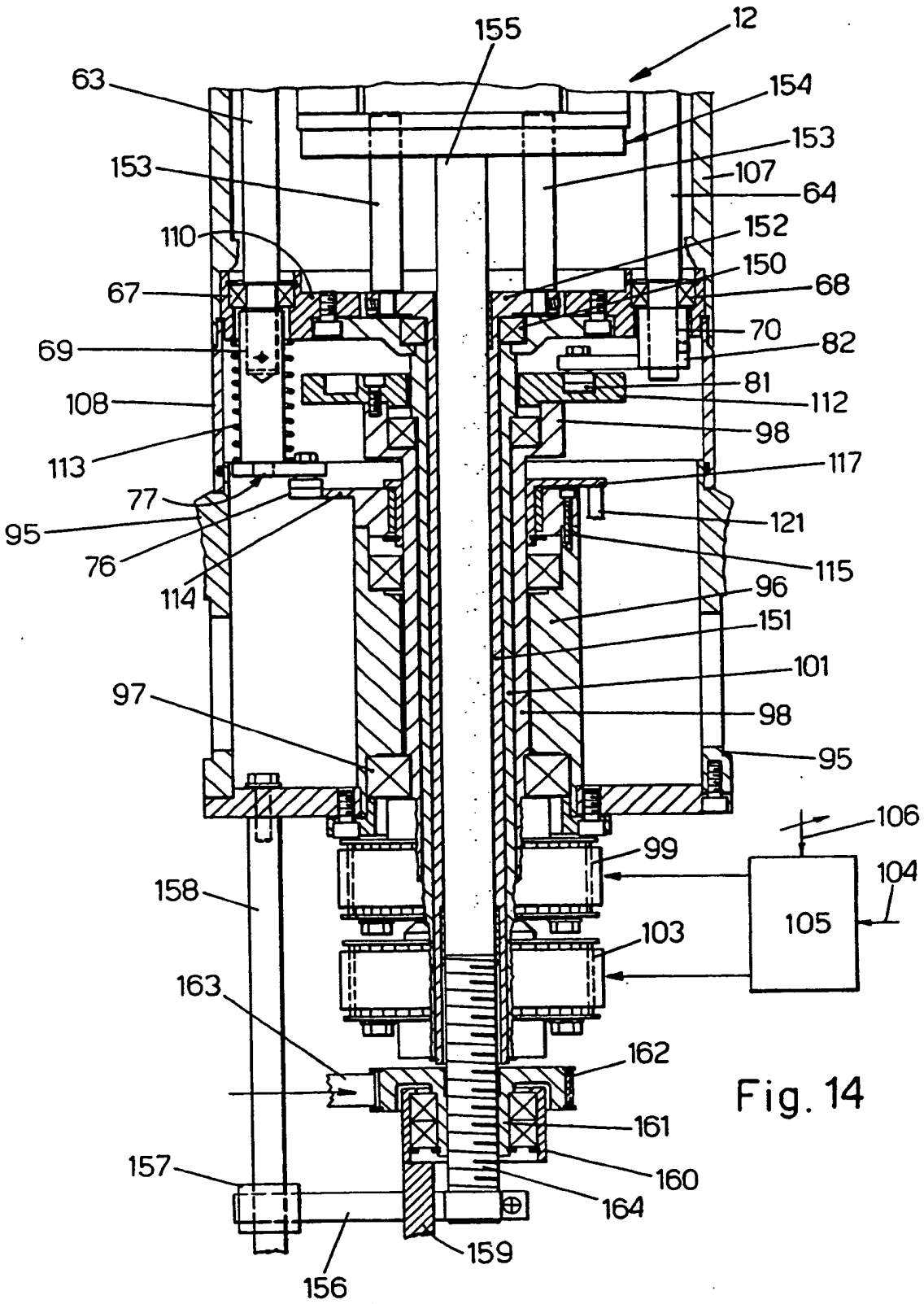


Fig. 14

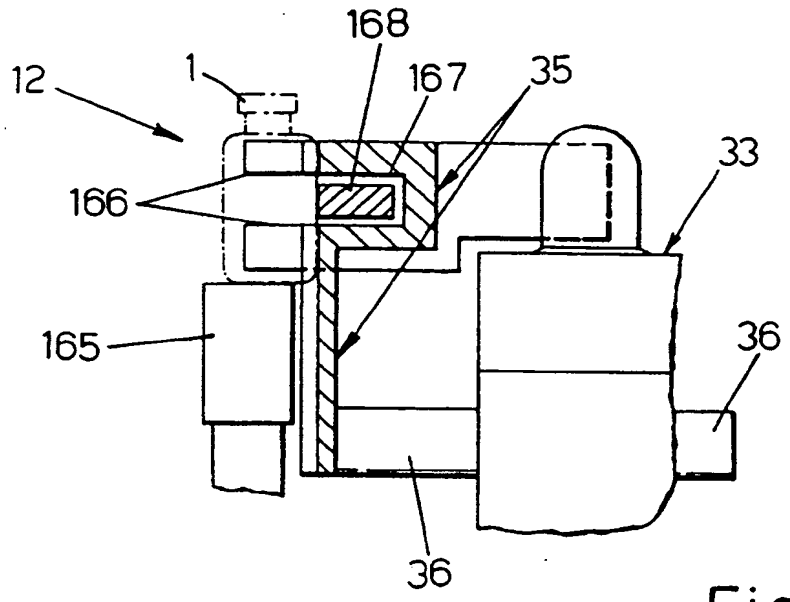


Fig. 15

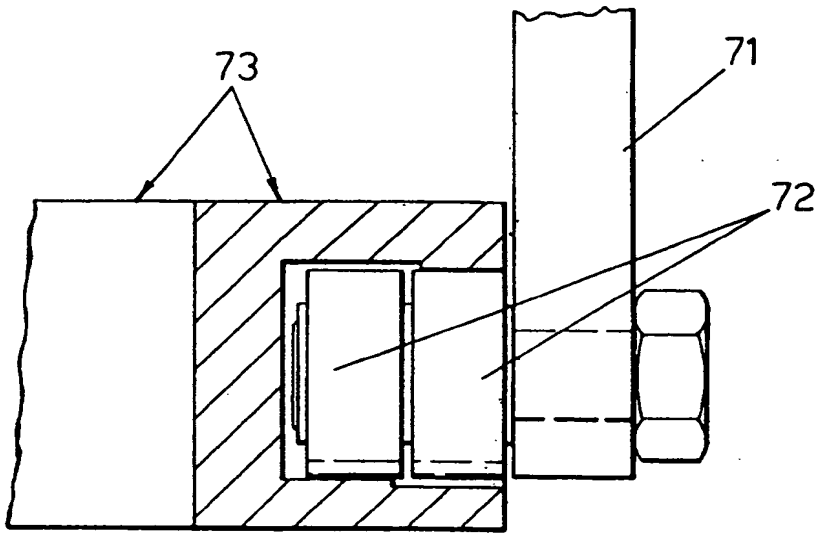


Fig. 17

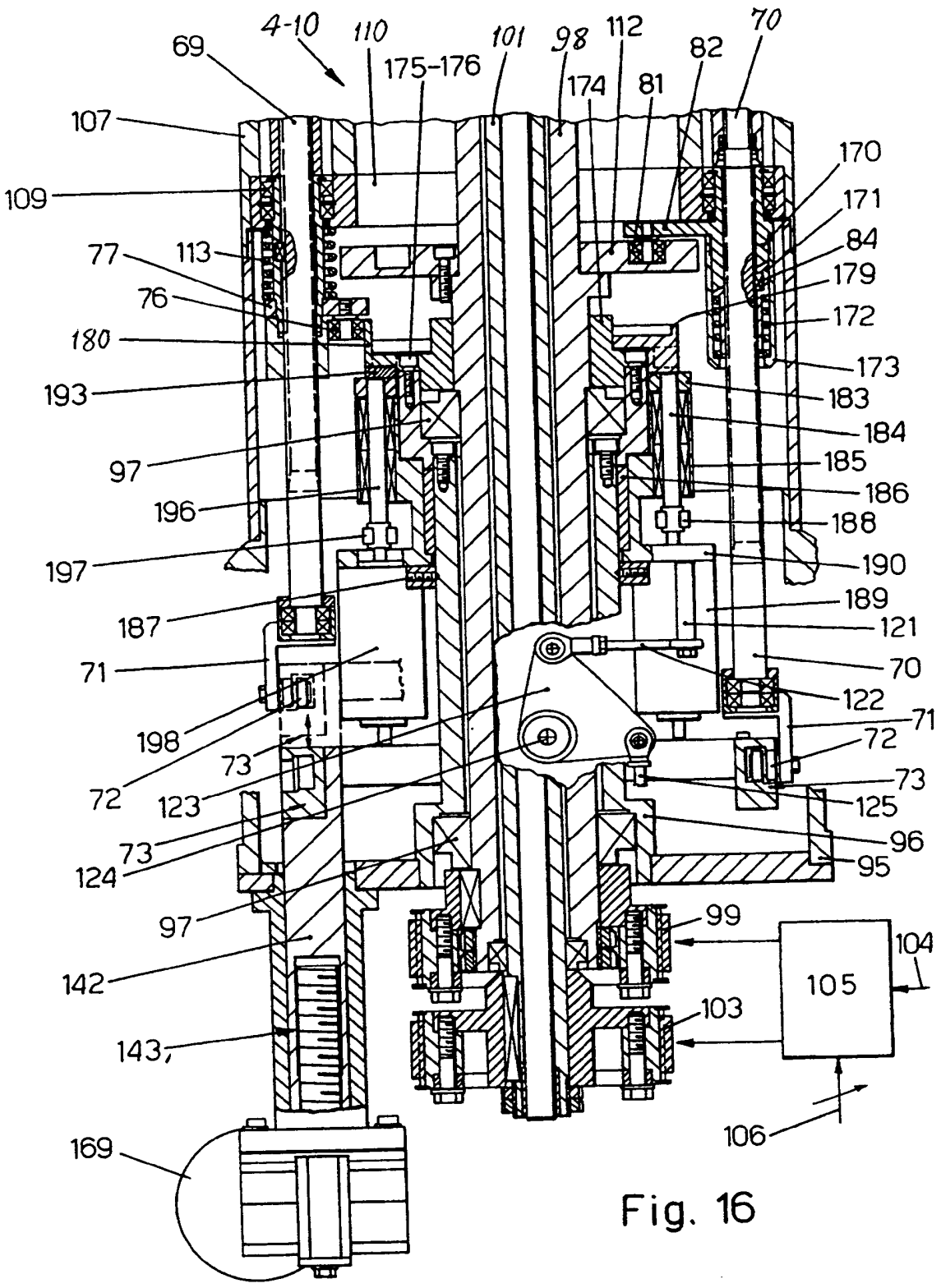


Fig. 16

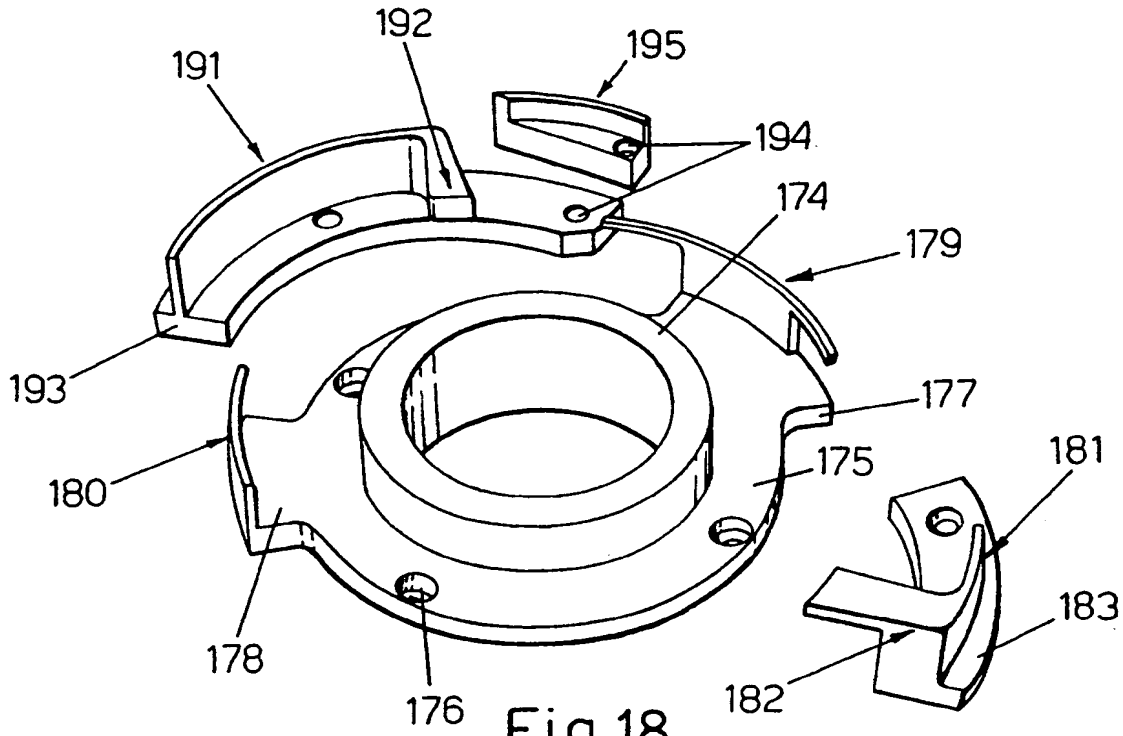


Fig.18

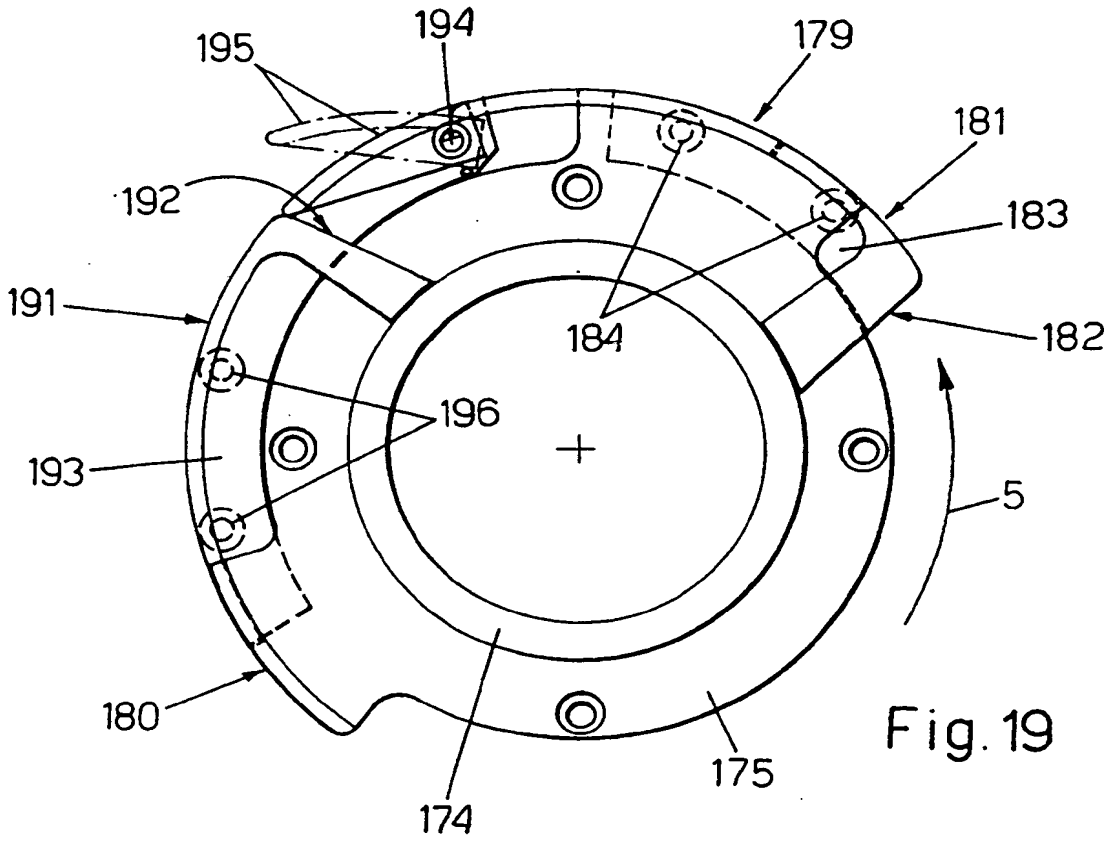


Fig.19

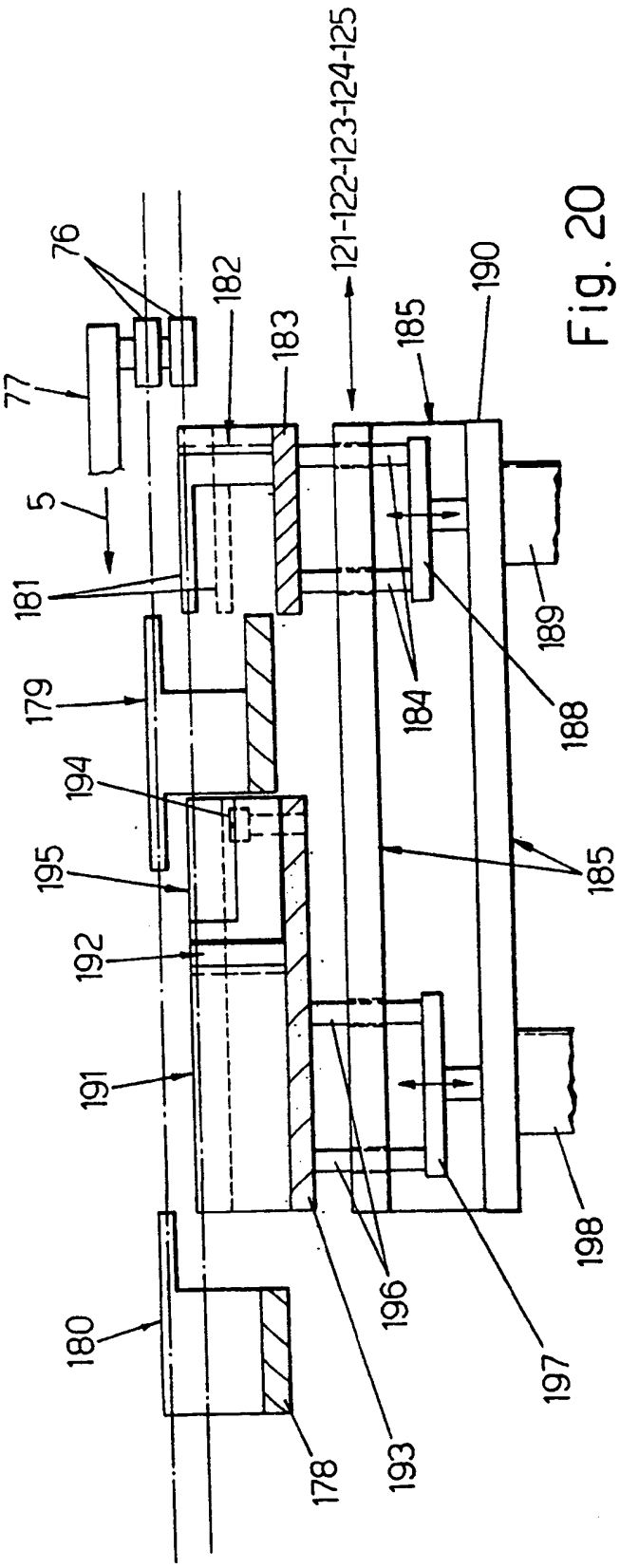


Fig. 20

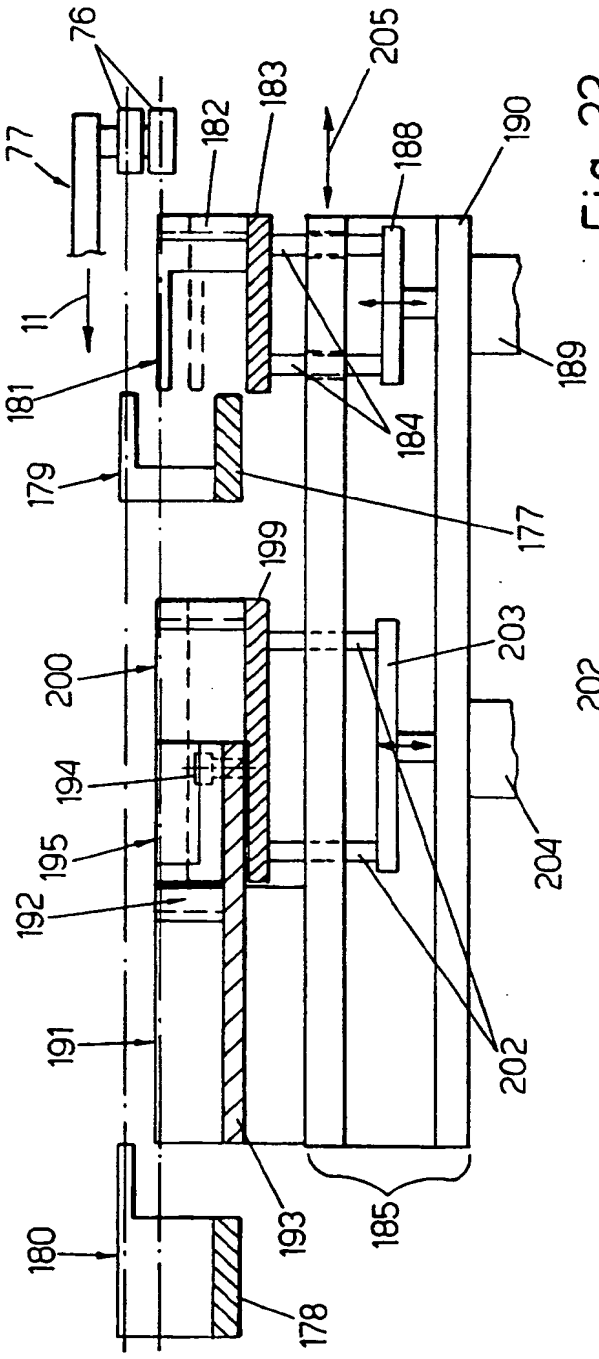


Fig. 22

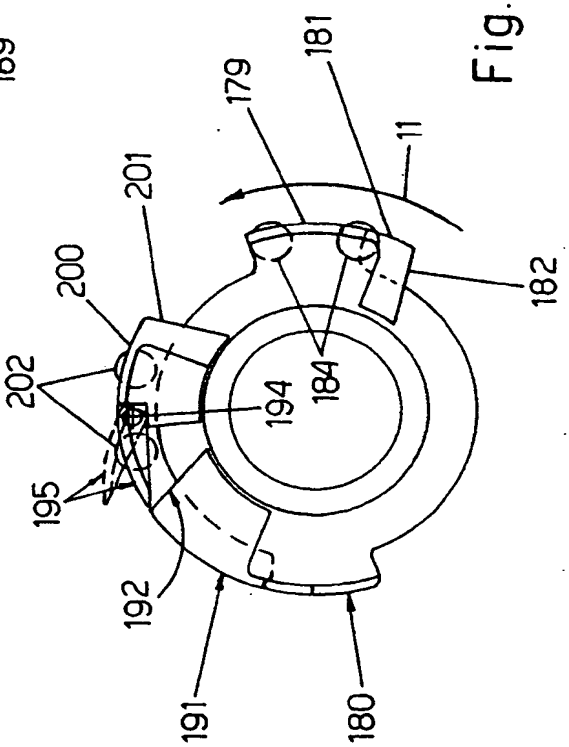


Fig. 21

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 11 9719

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP-A-0 005 402 (J. BEDIN) * page 3, line 10 - page 5, line 4 * * figures 1-3 *	1	B67C7/00 B67C3/24 B65G47/84
A	EP-A-0 486 439 (M. MARCHESINI) * column 1, line 51 - column 4, line 26 * * figures 1-3 *	1	
A	EP-A-0 366 225 (SHIBUYA KOGYO CO.) * column 5, line 51 - column 15, line 22 * * figures 1-11 *	1	
A	DE-A-37 13 016 (HOLSTEIN UND KAPPERT) * column 3, line 34 - column 4, line 22 * * figures 1,2 *	1	
A	DE-A-23 40 796 (INDUSTRIAL AUTOMATION CORP.) * page 7, line 40 - page 15, line 36 * * figures 1-12 *	1	
A	US-A-4 363 649 (Y. YAMATO ET EL.) * column 3, line 37 - column 8, line 31 * * figures 1-8 *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
B67C
B65G
B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	3 April 1995	Smolders, R

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
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L : document cited for other reasons

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